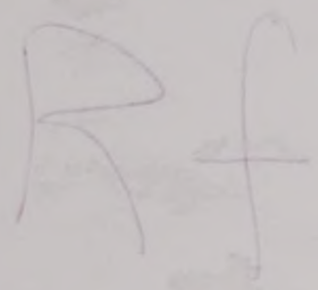
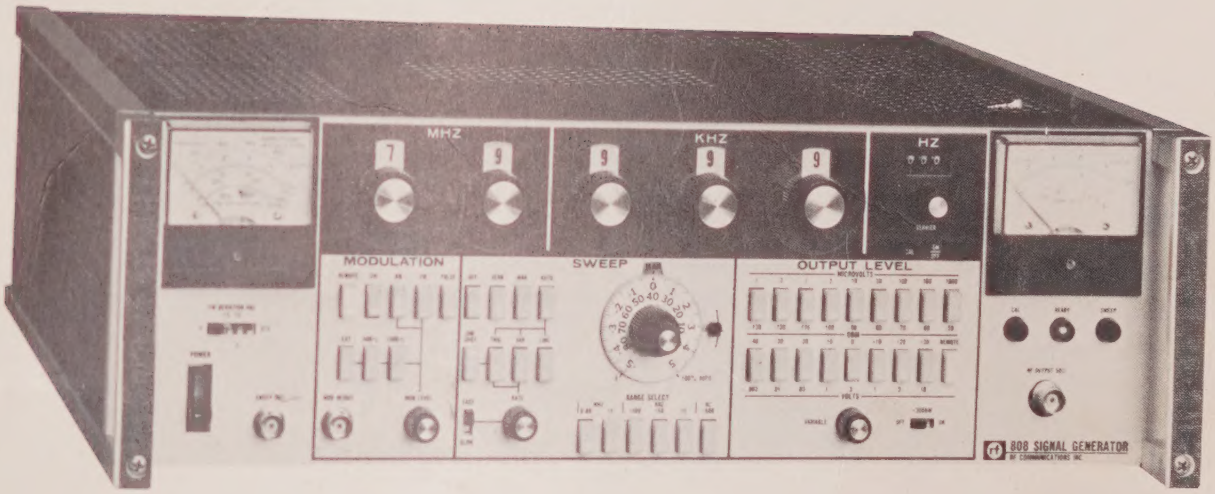


INSTRUCTION MANUAL HB-808



PRD → **RF-808**

Signal Generator

0235

RF COMMUNICATIONS, INC. ■ ROCHESTER, NEW YORK, U.S.A.

October 10, 1972

N O T I C E

The Electronic Instrumentation Operation of R F Communications, Inc. has been transferred by our parent company, Harris Intertype, Inc., to one of its sister divisions, PRD Electronics, Inc.

The Operation will now be known as the Electronic Instrumentation Group of PRD Electronics' Industrial Products Division.

PRD will continue to honor all equipment specifications and warranties without exceptions.

As usual, the Electronic Instrumentation Group Sales Department should be contacted at (716) 244-5830 to obtain authorization prior to returning any equipment for repair.

All equipment should be returned to:

PRD Electronics, Inc.
Electronic Instrumentation Group Repair Dept.
151 North John Sims Parkway
Valparaiso, Florida 32580

As usual, our Sales Department stands ready to assist you in any way possible with your instrumentation problems.

Sept. 19, 1972

RECOMMENDED MODES OF TRANSPORTATION FOR RETURNING EQUIPMENT TO ELECTRONIC INSTRUMENTATION GROUP REPAIR DEPT.

Air Freight

The air terminal for Valparaiso, Fla. is the Southern Airways terminal located on Eglin Air Force Base. The recommended connection point for air freight from northern and eastern locations is Atlanta, Ga. Connection points for air freight from western locations are New Orleans, La. or Atlanta, Ga.

All other conventional methods of land transport are available; United Parcel Service (UPS), Railway Express (REA), Truck freight, etc.

The only transportation not available is Railway Express Air Freight.

If you have questions concerning mode of transportation for any equipment you wish to return, please contact:

Russ Smith
PRD Electronics, Inc.
151 N. John Sims Pkwy.
Valparaiso, Fla. 32580
904-678-4181

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20 MHz Swp Osc. Assy.

All

RF-808 MODUEL AND PC BOARD ASSY. REPLACEMENT

Whenever Modules and/or P. C. Board Assys. are replaced in the RF-808 Signal Generator, refer to Section 6.24 of the HB808 Instruction Manual for "System Alignment and Adjustments" required.

Listed below are all "System Alignment and Adjustments; the appropriate paragraphs are circled for the alignments and adjustments you are required to make for the modules and/or P. C. Board Assys. you are replacing.

Section 6.24

Para. a b c d e f g h i j k l m n o p q r s t u v

4-17-97 DLP

T BE PERFORMED PRIOR

'EW MODULE INSTALLATION

NEW YORK

PRO ELECTRONICS, INC.
151 N. JOHN SIMS PARKWAY
VALPARAISO, FLA. 32580

FLORIDA

4-17-92 Dep

ADDENDUM TO INSTRUCTION MANUAL HB-808

RF-808 Signal Generator

AD-808-1
4/18/72

The following changes and errata should be incorporated in the RF-808 Instruction Manual, HB-808.

DIAL TRANSFER MECHANISM (Serial No. 317 and up)

The RF-808 Signal Generator is normally supplied with a Frequency Switch Assembly installed. This assembly does not provide the automatic "carry" or "borrow" feature to the next most significant digit when lesser digits pass from 0 to 9 or 9 to 0. The electrical connections to the Frequency Switch Assembly are identical to those of the Dial Transfer Mechanism (DTM) described in the RF-808 Instruction Manual.

The DTM is available as a factory installed option and, because of its greater complexity, is fully described in the RF-808 Instruction Manual.

FREQUENCY STANDARD

The Frequency Standard is available as one of three options, with different degrees of stability.

1. High Stability Standard with a maximum drift rate of 6×10^{-9} parts per month after warmup. RFC Part No. YX918081-1.
2. High Stability Standard with a maximum drift rate of 1.25×10^{-7} parts per month after warmup, 5×10^{-9} parts per day. RFC Part No. YX918081.
3. TCXO Standard with a maximum drift rate of 1×10^{-6} parts per month after warmup. RFC Part No. YX918281.

The selection of one of the above three frequency standards or no frequency standard at all may be made at time of purchase or may be changed as a field modification at a later date.

Chapter 7

Page 7-2

After R25 add:

S1-S9	Switch, Push, Assy.	SX058084

S10-S16 should be SX058082

After S45 add:

R5	Potentiometer (CAL), 2.5K	RX398282

ADDENDUM TO INSTRUCTION MANUAL HB-808

Under FRONT PANEL ASSEMBLY PARTS add:

A1	DTM Assembly (optional)	808-0085
A1	Frequency Switch Assembly (Standard)	828-0006
A1S1-A1S5	Wafer, Switch	SX1480801
	Detent, Switch (used with Frequency Switch Assembly only)	SX0882801

Change second DS1 to DS2

Add:	Button, Push, Gray	MP540001
	Button, Push, White	MP540002
	Button, Push, Black	MP540003

Under REAR PANEL ASSEMBLY PARTS add:

F1	Fuse, 0.75 Ampere, Slo-Blo (230V operation)	FX011751
F2	Fuse, 0.25 Ampere, Slo-Blo (230V operation)	FX011251

Page 7-3

Under RECTIFIER BOARD PARTS add:

C1	Capacitor, 4,800 μF, 50 VDC	CX02482500
C2	Capacitor, 8,200 μF, 25 VDC	CX02822250
C3	Capacitor, 42,000 μF, 10 VDC	CX02423100
C4	Capacitor, 16,500 μF, 15 VDC	CX02163150
C5	Same as C2	

Delete:

A21	Crystal, 1.000 MHz Standard	YX018082

Under MAIN (CHASSIS) ASSEMBLY PARTS add:

CR1	Rectifier, Bridge	CR208051

2.5K to description of R6

Page 7-4

Add:

A2	Vernier Assembly	808-0189
A2R4	Potentiometer (VERNIER) 2K	RX371202

ADDENDUM TO INSTRUCTION MANUAL HB-808

Page 7-22

Add:

A12	Attenuator Assembly	808-0083

Page 7-23

Q3 should be 2N5133
Q4 " " 2N3053

Page 7-52

Add:

A21	High Stability Frequency Standard ($\pm 6 \times 10^{-9}$ parts/month)	YX918081-1
A21	High Stability Frequency Standard ($\pm 1.25 \times 10^{-7}$ parts/month, $\pm 5 \times 10^{-9}$ parts/day)	YX918081
A21	TCXO Frequency Standard ($\pm 1 \times 10^{-6}$ parts/month)	YX918281

Chapter 6

Page 6-31

Paragraph 4, line 8 should read:

If, in addition, the tens kHz. . .

Page 6-9 /6-10, Figure 6-3

R48, connected to base of Q5, should be marked R50.

Page 6-11/6-12, Figure 6-3

R4 (VERNIER) should be 2K.

Page 6-29/6-30, Figure 6-5

R45 should be marked NEGATIVE SWEEP LIMIT
R55 " " " POSITIVE SWEEP LIMIT

Page 6-37/6-38, Figure 6-8

1 kHz SELECTION should read 1 MHz SELECTION

ADDENDUM TO INSTRUCTION MANUAL HB-808

Page 6-65

REMARK for IC2-5 should read:

Jumper between TP2 and TP3 open circuit

Page 6-95

Last line paragraph b: C2 should read CR2

Page 6-104, figure 6-27:

40 MHz CONTROL should read 0-80 MHz CONTROL

Page 6-107, paragraph b:

Pin 15 should be pin 22.

Page 6-131, paragraph 2, line 3:

R7 should read Q7

Page 6-131, paragraph 2, line 10:

IC5 should read IC2

Page 1-3, Frequency Characteristics, STABILITY should read:

Depends on Frequency Standard used. See Parts List under A21 for available standards.

Page 6-11/6-12, figure 6-3:

When the TCXO Frequency Standard, YX918281, is used, pins 6 and 7 of A21 are connected to the +12V supply, and the schematic should be marked accordingly.

WARRANTY

The Electronic Instrumentation Operation of RF Communications, Inc. warrants each new instrument to be free from defects in material and workmanship for a period of one year after shipment to the original purchaser. Repair or replacement, at our option, without charge (f.o.b. factory) will be made when our examination indicates that defects are due to workmanship or materials. Electronic tubes, batteries, fuses, and lamps are excluded from warranty coverage. All warranty returns must first be authorized in writing by the factory.

This warranty does not apply to any of our products which have been repaired or altered by persons not authorized by RF Communications, Inc. or not in accordance with instructions furnished by us. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, or if any serial number or seal has been removed or altered, the warranty is void and repairs will be billed at cost.

This warranty is in lieu of all other obligations or liabilities expressed or implied and RF Communications, Inc. neither assumes nor authorizes any person to assume for them, any other liability in connection with sales of its instruments.

REPAIR AND MAINTENANCE

Instruments should be returned only upon prior written authorization from the Electronic Instrumentation Operation of RF Communications, Inc. or its authorized sales and service representative. Warranty repair will be made upon written request. Please provide the following information in order to enable us to serve you efficiently:

1. Model or type
2. Serial number
3. Description of trouble
4. Approximate number of hours of use

Upon receipt of this information our service department will send you service data or shipping instructions.

For assistance contact your nearest RF Communications sales representative.

TABLE OF CONTENTS

Para.		Page
	CHAPTER 1 INTRODUCTION	
1.1	General Description	1-1
1.2	Useful Accessories	1-2
1.3	Specifications	1-3
	CHAPTER 2 PREPARATION	
2.1	Initial Inspection	2-1
2.2	Claim for Damage	2-1
2.3	Performance Check	2-1
2.4	Power Requirements	2-1
2.5	Power Cable Ground Protection	2-2
2.6	Mounting	2-2
2.7	Packaging for Reshipment	2-2
	CHAPTER 3 OPERATION	
3.1	Introduction	3-1
3.2	Operating Notes	3-1
3.3	Initial Turn On	3-3
3.4	General Operation	3-4
3.5	Modulation	3-4
3.6	Sweep	3-5
	CHAPTER 4 REMOTE PROGRAMMING	
4.1	General	4-1
4.2	Logic Levels	4-1
4.3	Frequency Programming	4-1
4.4	Output Level Programming	4-2
4.5	Modulation Programming	4-2
4.6	Interface Converters	4-2
4.7	Connector	4-3
	CHAPTER 5 TROUBLESHOOTING	
5.1	Introduction	5-1
5.2	Reference Designations	5-1
5.3	Module and PC Board Removal Procedures	5-2
5.4	Principles of Operation	5-6
5.5	Performance Test	5-23
5.6	Troubleshooting Procedures	5-28

Para		Page
	CHAPTER 6 MAINTENANCE	
6.1	Introduction.	6-1
6.2	Preventive Maintenance	6-1
6.3	Test Equipment	6-1
6.4	Printed Circuit Board Repairs	6-2
6.5	Front Panel and Main Frame	6-4
6.6	Sweep Buffer PC Board A3	6-7
6.7	Attenuator Switch Assembly A4	6-13
6.8	Modulation/Sweep PC Board A5	6-15
6.9	Programmable Frequency Divider	6-31
6.10	20–30 MHz Oscillator PC Board A8	6-43
6.11	Sweep/Sample and Hold PC Board A9	6-51
6.12	20 MHz PLL PC Board A10	6-61
6.13	20 MHz Sweep PC Board A11	6-71
6.14	Attenuator Assembly A12	6-83
6.15	Power Supply Regulator PC Board A13	6-87
6.16	VHF Loop A Module A14	6-93
6.17	VHF Loop B Module A15	6-103
6.18	Discriminator PC Board A16	6-115
6.19	Mixer/Divider PC Board A17	6-125
6.20	AM Output Loops PC Board A18	6-131
6.21	Output Amplifier Module A19	6-139
6.22	Standard Divider PC Board A20	6-147
6.23	Frequency Standard Module A21	6-115
6.24	System Alignment and Adjustment	6-157
	CHAPTER 7 PARTS LIST	
7.1	Parts List	7-1
7.2	Ordering Replacement Parts	7-1

LIST OF ILLUSTRATIONS

Figure		Page
3-1	RF-808 Signal Generator; Controls, Indicators and Connectors	3-9
4-1	Remote Connector Pin Identification, Rear Panel View	4-3
5-1	RF-808 Top View (Covers Removed)	5-3
5-2	RF-808 Bottom View (Covers Removed)	5-4
5-3	Basic Synthesizer Block Diagram, Fully Synthesized Modes Only	5-7
5-4	Frequency Synthesis Scheme CW Mode, Block Diagram	5-9
5-5	Sweep Modes, Block Diagram	5-13
5-6	Modulation and Sweep Signal Generators, Block Diagram	5-15
5-7	AM Loop and Output Amplifier, Block Diagram	5-17
5-8	FM Mode Operation, Block Diagram	5-19
5-9	Attenuator Circuits, Block Diagram	5-20
5-10	Power Supply Circuits, Block Diagram	5-22
6-1	RF-808 Front Panel, Rear View	6-5
6-2	Parts Location, Assembly A3 (REV E)	6-9
6-3	RF-808 Main Frame, Schematic Diagram (1 of 2)	6-9
6-3	RF-808 Main Frame, Schematic Diagram (2 of 2)	6-11
6-4	Parts Location Assembly A5 (REV J)	6-27
6-5	Modulation/Sweep PC Board A5, Schematic Diagram	6-29
6-6	Low Speed Divider Counter Sequence	6-33
6-7	Parts Location, Assembly A6 (REV J)	6-37
6-8	Low Speed Divider Board A6, Schematic Diagram	6-37
6-9	High Speed Divider Counter Sequence	6-40
6-10	Parts Location, Assembly A7	6-41
6-11	High Speed Divider PC Board A7, Schematic Diagram	6-41
6-12	Parts Location, Assembly A8 (REV F)	6-49
6-13	20–30 MHz Oscillator PC Board A8, Schematic Diagram	6-49
6-14	Parts Location, Assembly A9 (REV M)	6-59
6-15	Sweep/Sample and Hold PC Board A9, Schematic Diagram	6-59
6-16	Parts Location, Assembly A10 (REV E)	6-69
6-17	20 MHz PLL PC Board A10, Schematic Diagram	6-69
6-18	Parts Location, Assemblies A11A2, -A3 (REV E)	6-80
6-19	Parts Location, Assembly A11A1 (REV H)	6-81
6-20	20 MHz Sweep PC Board A11, Schematic Diagram	6-81
6-21	Parts Location, Assembly A12A1 (REV D)	6-85
6-22	Parts Location, Assembly A13 (REV M)	6-91
6-23	VHF Loop A Module A14, Block Diagram	6-94
6-24	Parts Location, Assemblies A14A1 (REV G), A14A2 (REV D), A14A3 (REV G), and A14A4 (REV F)	6-99
6-25	Parts Location, Assembly A14A5 (REV F)	6-101
6-26	VHF Loop A Module A14, Schematic Diagram	6-101
6-27	VHF Loop B Module A15, Block Diagram	6-104
6-28	Parts Location, Assemblies A15A1 (REV C), A15A2 (REV F), A15A3 (REV G), and A15A4 (REV D)	6-111
6-29	Parts Location, Assembly A15A5 (REV H)	6-113
6-30	VHF Loop B Module A15, Schematic Diagram	6-113
6-31	Parts Location, Assembly A16 (REV G)	6-123
6-32	Discriminator PC Board A16, Schematic Diagram	6-123

LIST OF ILLUSTRATIONS (Cont)

Figure		Page
6-33	Divider Sequence A17	6-126
6-34	Parts Location, Assembly A17 (REV K)	6-129
6-35	Mixer/Divider PC Board A17, Schematic Diagram	6-129
6-36	Parts Location, Assembly A18 (REV K)	6-137
6-37	AM Output Loops PC Board A18, Schematic Diagram	6-137
6-38	Parts Location, Assembly A19 (REV G)	6-143
6-39	Parts Location, Assembly A19 (Component Side)	6-145
6-40	Output Amplifier Module A19, Schematic Diagram	6-145
6-41	Standard Divider Sequence	6-148
6-42	Parts Location, Assembly A20 (REV D)	6-153
6-43	Standard Divider PC Board A20, Schematic Diagram	6-153
6-44	Suitable Test Setup for Checking or Calibrating RF-808 Frequency Standard	6-156
6-45	Power Supply Regulator PC Board A13, Adjustment Controls	6-160
6-46	Modulation/Sweep PC Board A5, Adjustment Controls	6-164

LIST OF TABLES

Table		Page
4-1	Remote Connector Pin Functions	4-3
5-1	List of Modules and Assemblies	5-1
5-1	RF-808 General Troubleshooting Procedures	5-29
5-2	CW Mode, Frequency and Output Checks	5-31
5-3	AM Mode, Modulation and Frequency Checks	5-32
5-4	FM Mode, Modulation and Frequency Checks	5-32
5-5	Pulse Modulation Check	5-33
5-6	CW Mode, Zero Beat and Frequency Checks	5-33
5-7	CW Mode, Frequency Check	5-34
5-8	CW Mode, Sweep Checks	5-35
5-9	Remote Operation Checks	5-36
6-1	A3 Transistor Voltage Chart	6-8
6-2	A3 Integrated Circuit DC Voltage Chart	6-8
6-3	A3 Connector Pin Voltage Chart	6-8
6-4	A5 Transistor Voltage Chart	6-22
6-5	A5 Integrated Circuit DC Voltage Chart	6-23
6-6	A5 Test Point and Connector Pins Voltage Chart	6-24
6-7	A5 Waveform Data Chart	6-25
6-8	A6 Low Speed Divider Frequency Chart	6-35
6-9	A8 Transistor Voltage Chart	6-45
6-10	A8 Integrated Circuit DC Voltage Chart	6-46
6-11	A8 Test Point and Connector Pins Voltage Chart	6-46
6-12	A8 Waveform Data Chart	6-47
6-13	A9 Transistor Voltage Chart	6-53
6-14	A9 Integrated Circuit Voltage Chart	6-53
6-15	A9 Test Point and Connector Pin Voltage Chart	6-53

LIST OF TABLES (Cont)

Table		Page
6-16	A9 Waveform Chart	6-54
6-17	A10 Transistor Voltage Chart	6-63
6-18	A10 Integrated Circuit Voltage Chart	6-63
6-19	A10 Test Point and Connector Pin Voltage Chart	6-63
6-20	A10 Waveform	6-64
6-21	A11 Transistor Voltage Chart (Sub-assembly A11A1)	6-74
6-22	A11 Transistor Voltage Chart (Sub-assembly A11A2)	6-74
6-23	A11 Transistor Voltage Chart (Sub-assembly A11A3)	6-75
6-24	A11 Connector Pin Voltage Chart (Sub-assembly A11A1)	6-75
6-25	A11 Connector Pin Voltage Chart (Sub-assembly A11A3)	6-76
6-26	A11 Waveform Chart	6-77
6-27	A12 Transistor Voltage Chart	6-84
6-28	A12 Integrated Circuit DC Voltage Chart	6-84
6-29	A12 Connector Pin Voltage Chart	6-84
6-30	A13 Transistor Voltage Chart	6-89
6-31	A13 Integrated Circuit Volgate Chart	6-89
6-32	A13 Test Point and Connector Pin Voltage Chart	6-90
6-33	A14 Voltage and Waveform Chart	6-96
6-34	A15 Voltage and Waveform Chart	6-108
6-35	A16 Transistor Voltage Chart	6-118
6-36	A16 Integrated Circuit DC Voltage Chart	6-119
6-37	A16 Connector Pin Voltage Chart	6-119
6-38	A16 Waveform Chart	6-120
6-39	A17 Transistor Voltage Chart	6-127
6-40	A17 Test Point Voltage Chart	6-127
6-41	A17 Waveform	6-127
6-42	A18 Transistor Voltage Chart	6-133
6-43	A18 Integrated Circuit DC Voltage Chart	6-134
6-44	A18 Test Point Voltage Chart	6-134
6-45	A18 Waveform Chart	6-134
6-46	A19 Transistor Voltage Chart	6-141
6-47	A19 Test Point & Connector Pin Voltage Chart	6-141
6-48	A19 Waveform Chart	6-142
6-49	A20 Waveform Chart	6-149

CHAPTER 1

INTRODUCTION

1.1 GENERAL DESCRIPTION.

The RF-808 Signal General is a solid-state frequency synthesizer which is combined with a calibrated attenuator, AM, FM and Pulse modulation capabilities, internal 400 Hz and 1000 Hz audio oscillators, and manual and automatic frequency sweep capabilities. The combination of these features permits the RF-808 to be used as a digital frequency synthesizer with frequency standard accuracy, a conventional signal generator, or a sweep frequency generator. The RF-808 provides output frequencies from 0.05 MHz to 80 MHz synthesized in 1 kHz steps. A VERNIER interpolation oscillator is provided to cover the range between the 1 kHz steps with better than 1 Hz accuracy. In addition, sweep circuits are provided which will allow manual or automatic sweeping from small portions to almost the entire frequency range of the generator. The unit features remote programming, digital (decade) frequency setting with a dial transfer mechanism (DTM), high available output, FM, AM, and pulse modulation, manual and automatic sweep. Pushbutton controls are used for operator convenience. Front panel meters monitor modulation and output level. The unit is designed for bench use or rack mounting with a rack mount kit.

The RF-808 has a calibrated pushbutton attenuator on the front panel with 10 dB steps to provide 0.1 microvolts to 10 volts into 50 ohms. A VARIABLE LINE control adjusts the output level between the 10 dB steps. The OUTPUT VOLTS meter is calibrated in volts and dBm, and automatic levelling is provided internally. Output VSWR, distortion, spurious, and residual FM are all low.

The basic frequency generation is provided by a frequency synthesizer that is locked to an internal or external 1 MHz crystal frequency standard. Phase locked loops are used in the frequency generating scheme. State of the art linear mixer design and an advanced synthesis scheme yield an output frequency that is remarkably spurious and noise free.

Stability when locked to the internal frequency standard is better than 5 parts in 10^9 per day, or better than 1.25 parts in 10^7 per month. Alternate frequency standards are available. The synthesized frequency is adjusted in 1 kHz steps using rotary controls interconnected by a dial transfer mechanism (DTM), which automatically changes the control for the next higher digit when changing between "9" and "0" or "0" and "9". A VERNIER frequency control, which may be calibrated during operation with metering provided, is used, when desired, to obtain frequencies between the 1 kHz steps with accuracy to 1 Hz.

Two sweep modes are provided; manual and automatic, selected by pushbuttons on the front panel. The full scale sweep range can be selected in decade ranges from $\pm$ 500 Hz to $\pm$ 5 MHz about the selected frequency. The percentage of the range to be swept is determined by a front panel control, when in the AUTOMATIC SWEEP mode. The same control determines the output frequency in the MANUAL SWEEP mode.

Automatic sweep may be internally synchronized with the power line, may be varied with a rate adjustment when using the VARIABLE SWEEP mode, or synchronized to an external sync source. Fast and slow sweep speeds are provided for operation with both X-Y recorders and oscilloscopes. External triggering may be used, and a ONE SHOT pushbutton on the front panel gives a single sweep generation. Pen lift, blanking, and other auxiliary outputs and inputs are provided on the rear panel.

In the MANUAL SWEEP mode a front panel control changes frequency much the same as a VFO standard signal generator and thus the RF-808 retains the capability of continuous tuning for response searching. In the manual mode an additional sweep is available, from 1 to 80 MHz.

Three major functions of the RF-808 Signal Generator may be programmed remotely. These are:

1. Output Level
2. Frequency
3. Modulation

Remote programming through a rear connector is accomplished by means of a computer compatible binary code. Analog voltages can also be used with some functions for greater programming capability.

1.2 USEFUL ACCESSORIES.

815-0114	Rack Mount Kit
MP480000	Circuit Board Extractor Tool. Facilitates removal of printed circuit assemblies.
JX028081	Mating Connector Assembly. RF-808 Remote Programming input.
808-0170	Extender Board. Permits accessibility to RF-808 assemblies A6 through A11, A13, A16 and A19. Not required for routine alignment.
808-0356	Extender Cable Assembly. Permits complete accessability to all RF-808 assemblies except R20. Two Extender Cable assemblies required for A17 and A18. This cable assembly is required for normal alignment.
808-0370	Extender Board. Permits complete accessability of RF-808 Assembly A20. Not required for routine alignment.
RF-805	RF-805 Amplifier, a solid state linear broadband power amplifier is available to provide up to ten watts output into 50 ohms over the 50 kHz to 80 kHz range of the RF-808 Signal Generator. No tuning is required, and protection is provided against overdrive or high load VSWR damage.

1.3 SPECIFICATIONS.

Nominal physical and electrical specifications are as follows:

Frequency Characteristics

RANGE: 50 kHz to 80 MHz.

STABILITY: 5 parts in 10^9 per day in synthesized mode with internal frequency standard.

SETTABILITY: 1 kHz digital steps, vernier calibration to 1 Hz.

HARMONICS AND SPURIOUS OUTPUTS: Harmonics 35 dB and spurious output 65 dB below carrier.

Output Characteristics

LEVEL: 0.1 uV to 10 volts rms into 50 ohms, in 10 dB steps with variable level control between steps.

ACCURACY: Better than ± 1 dB.

IMPEDANCE: 50 ohm source below 3 volts.

Amplutude Modulation

INTERNAL AM: 400 Hz and 1000 Hz up to 95% modulation. Less than 1% envelope distortion to 30% modulation.

EXTERNAL AM: DC to 100 kHz up to 95% modulation. 7V peak-peak required for 95% modulation.

Frequency Modulation

INTERNAL FM: 400 and 1000 Hz up to 375 kHz deviation. Less than 3% distortion up to 75 kHz diviation.

EXTERNAL FM: 30 to 100 kHz up to 375 kHz diviation. 7V peak–peak required for full-scale deviation.

STABILITY: FM center frequency phase-locked to standard for modulation rates above 30 Hz.

Pulse Modulation

ON/OFF RATIO: 60 dB.

RISE AND FALL TIME: 25 nanoseconds.

Sweep Characteristics

MANUAL MODE: In five symmetrical ranges of ± 500 Hz, ± 5 kHz, ± 50 kHz, ± 500 kHz, and ± 5 MHz about selected frequency plus from 1 to 80 MHz.

AUTOMATIC MODE:

Width: In five symmetrical ranges of ± 500 Hz, ± 5 kHz, ± 50 kHz, ± 500 kHz and ± 5 MHz about selected frequency. Adjustable 0 to 100% of selected range.

Rate: FAST, 6 to 80 sweeps per second, variable.
SLOW, 8 to 100 seconds per sweep, variable.

Sync: Manual one-shot trigger, external trigger, line frequency, or adjustable free-running.

Auxiliary Outputs and Inputs

FRONT PANEL:

Sweep Out: In AUTOMATIC SWEEP MODE only. Sawtooth waveform between –5 and +5 volts from a 4.7K ohm source impedance covers selected sweep range. Retrace time approximately 10% of sweep time. Linearity of sweep frequency vs. sweep voltage is 1%. Accuracy is ± 10%.

Mod In/Out:

Internal Audio Output: 2.0V rms from a source impedance of 82K ohms. Total harmonic distortion less than 0.4%. Frequency of 400 Hz ± 5% or 1000 Hz ± 5% is available when internal oscillator is activated.

External Modulation Input:

1) AM Mode: Frequency range is 10 Hz to 100 kHz . Input Impedance is 1.2K ohms to 2.5K ohms. Modulation sensitivity is 7 volts peak–peak, 2.5V rms for 95% modulation.

2) FM Mode: Frequency range is 20 Hz to 100 kHz. Input Impedance is 1K ohms to 2.5K ohms as a function of the MOD LEVEL control. Modulation sensitivity is 7V peak–peak 2.5V rms for full scale deviation.

3) Pulse Mode: Input Impedance is 50 ohms. Off level range is –3 to +0.4 volts. On level range is +2 to +5 volts.

REAR PANEL:

Pen Lift Signal: Contact closure during sweep, open during retrace. Contact rating 10W or 12VA, 0.5A or 50 volts maximum. $12=(E)(I) \quad = 12=(E)(.5) \quad E=24$

External Sweep Trigger: Input Impedance is one RTL logic load, 450 ohms to ground. Pulse width is 1 microsecond minimum. Trigger level required is +1 volt minimum into 450 ohms. +6 volts is maximum input permitted. Off level is 0 ± 0.5 volts. Input frequency is 0 to 100 Hz. Triggering takes place on the positive going edge of input pulse.

Blanking Output: +24 volts from a 6.8K ohm source during sweep. +0.5V during retrace with a current sinking capability of 10 milliamperes.

Auxiliary r.f. output: 100 millivolts minimum from a 50 ohm source with a frequency the same as that from the front panel RF OUT connector.

Internal frequency standard output: 1 MHz square wave between 0 and +3 volts from RTL logic. Source impedance is 640 ohms.

External frequency standard input:

a) 1 MHz sinewave of 1.5 ± 0.5 V rms.

b) Squarewave between 2 and 4 volts peak–peak symmetrical about ground.

c) Squarewave operating between RTL logic levels, low level +0.4 volts max, ligh level +1 to +4 volts.

Inpedance level is 300 ohms.

Remote Programming Signal Inputs: See Chapter 4.

General Characteristics

POWER: 115 or 230V ± 10%, 47–420 Hz, 115 watts. Maximum initial power at high line voltage is 175 watts.

WEIGHT: 40 lbs.

DIMENSIONS: 5¼ inches high X 17 inches wide X 16¾ inches deep to front panel. (18½ inches deep including handles).

CONSTRUCTION: Modular, all solid state, integrated circuitry where practicable.

CHAPTER 2

PREPARATION

2.1 INITIAL INSPECTION.

If damage to the shipping carton is evident, ask that the Carrier's Agent be present when the instrument is unpacked. Check the equipment for damage, and inspect the cabinet and panel surfaces for dents and scratches.

2.2 CLAIM FOR DAMAGE.

If the RF-808 Signal Generator is mechanically damaged or fails to meet specifications upon receipt, notify the Carrier and nearest RF Communications, Inc. Representative immediately. Retain shipping carton and packing material for the Carrier's inspection as well as the subsequent use in returning the unit if necessary. For assistance at any time, including assistance with instruments under warranty, contact your RF Communications, Inc. Representative.

2.3 PERFORMANCE CHECK.

The electrical performance of the RF-808 Signal Generator should be verified as soon as possible after receipt, using the tests of paragraph 5.5. Prior to performing tests, read Chapter 3 thoroughly to become familiar with operation.

2.4 POWER REQUIREMENTS.

The RF-808 Signal Generator requires a power source of 115 or 230 volts AC $\pm$ 10%, 47 – 420 Hz, single-phase, 115 watts.

The two-position slide switch mounted on the rear panel permits operation from either the 115 or 230 power source. The screwdriver slot in the slider must be pushed toward the 115 or 230 volt label depending upon the line voltage from which the instrument is to be operated.

Adjacent to the line voltage labeling is marked the correct fuse ratings for each line voltage. The fuses are of the slow-blow type and 3AG size. Check to be sure that fuses of the correct ratings are installed.

CAUTION

To avoid damage to this instrument, set the 115/230 volt slide switch for the line voltage to be used before connecting the power cable to the power source.

Separate fuses are used for the 24 volt power supply and the rest of the circuits to allow the oscillator ovens to remain on when the rest of the unit is turned off. The 24 volt circuits are not controlled by the front panel POWER switch. Since the ovens take several hours for complete stabilization, bench or rack power should be left on at night and other times when the unit is not in use. Since the 24 volt circuits are energized whenever the instrument is plugged in, caution should be exercized when servicing.

2.5 POWER CABLE GROUND PROTECTION.

To protect operating personnel, the RF-808 Signal Generator is equipped with a three conductor power cable and plug which, when inserted in an appropriate receptacle, grounds the panel and cabinet. The offset pin on the power cable three-prong connector is the ground pin.

To preserve the protection feature, when operating the instrument from a two contact outlet, use a three-prong adapter and connect the green pigtail on the adapter to ground.

2.6 MOUNTING.

The RF-808 Signal Generator is normally set on a bench during operation, however it can also be mounted on a rack if desired.

The Signal Generator may be rack mounted, using the rack mount kit described in paragraph 1.2. To install the rack mount panel extensions, remove two screws from each handle assembly on the front panel. Reinstall with the panel extensions between the front panel and the handle spacers. When installed in a cabinet, some support should be provided under the unit.

2.7 PACKAGING FOR RESHIPMENT.

Whenever possible, the original shipping carton and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. A carton made of at least 400 lb. test material, will usually provide adequate protection. Use shock absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container. A minimum of three inches of material should be used for each side. Protect the front panel by means of cardboard or other material which will not scratch the meter faces or front panel. Use extra material around the outside of projecting parts of the instrument to relieve these parts of any unnecessary shock. Close the carton securely and seal with durable shipping tape.

CAUTION

Mark the shipping container FRAGILE to assure careful handling.

In correspondence relative to this instrument, be sure to refer to the model number and serial number.

CHAPTER 3
OPERATION

3.1 INTRODUCTION.

This chapter provides operating instructions, descriptions of controls, indicators, and connectors, and general notes and cautions which should be observed during operation. Descriptions and identification of controls, indicators, and connectors are at the end of this chapter on figure 3-1, which folds out for convenient reference while the manual is opened to other parts of this chapter. Read over all of the control descriptions before operating the instrument to become familiar with their effects.

The RF-808 Signal Generator may be operated remotely in addition to local operation. Instructions for setup to allow remote programming are presented separately in Chapter 4.

3.2 OPERATING NOTES.

Following are some general items which you should consider when using the RF-808 Signal Generator.

3.2.1 Frequency Stabilization.

The frequency standard oven in the RF-808 requires approximately 24 hours after power is first applied to reach the specified frequency stability. The generator can still be used before this length of time, but without the precision for which it is intended. The unit will actually be quite close to stabilization after about 15 minutes – at least close enough for general use. As with all frequency standards of its type, the oven-enclosed 1 MHz standard in the RF-808 should be left with power always applied. Power for the standard (and the other 24 volt circuits in the unit) is not switched by the front panel POWER switch, and a separate fuse is provided to keep power applied whenever the instrument is plugged in. Arrangements should be made to ensure that bench or rack power to the generator is not turned off at night. Since operation of the front panel POWER switch does not affect the frequency standard, the POWER switch can be turned off when the generator is not in immediate use. When servicing, remember that the 24 volt power supply is always on when the unit is plugged in.

The sweep and vernier oscillators require at least 1½ hours from cold start before they are stabilized. The generator can, however, still be used during warm-up, with some loss of accuracy.

3.2.2 Frequency Standard Input/Output.

For normal operation, the rear panel FREQ STD selector should be set to INT. In this position, the synthesizer in the generator is locked to the internal 1 MHz frequency standard oscillator, and the oscillator signal is available for external use at the rear panel FREQ STD connector. For operation with the synthesizer locked to an external very high accuracy frequency standard or to the standard in another RF-808 Signal Generator, the rear panel FREQ STD selector should be set to EXT, and the 1 MHz standard signal should be fed into the FREQ STD BNC type connector through a 50 ohm coaxial cable. Nominal output is 3V square wave behind 700 ohms; nominal input level is 2 VRMS into 300 ohms.

3.2.3 RF Output Termination.

The attenuator in the RF-808 is calibrated for termination into an external 50 ohm load. For calibrated use with other load impedances, a terminating load or a 10:1 divider should be employed.

Connections should be made with a BNC plug attached to a 50 ohm coaxial cable. Single braid cables, such as RG-58/U can be used successfully for levels down to approximately 30 microvolts. For lower levels, double-braid shielded cable such as RG-55U or solid shielded cable is recommended.

When making connections to any circuit having a dc component, a blocking capacitor of suitable voltage rating should be used in series with the test load to prevent dc current flow through the attenuator in the generator. A handy test cable for direct connections to circuit elements in a receiver or similar unit can be made by stripping and separating the shield and inner conductor of a three foot cable, installing a miniature alligator clip on the shield lead, and soldering a disc capacitor (with a clip on the other end) to the inner conductor.

Care must be exercised when testing transceiver type radio equipment to avoid keying the transmitter circuitry while the signal generator is connected to the antenna connector. This cannot be overemphasized; since it is a very common error, which occurs solely because of failure to take preventive measures against such a possibility. It is very easy, when aligning a set, to forget that a generator is connected and key the transmitter, thus burning out the attenuator in the signal generator. A firm practice should be established of unplugging the push-to-talk microphone or other keying device before connecting any signal generator.

When using the high output range (+30 dBm or 10 volts), it is necessary to turn on the +30 dBm interlock switch in addition to depressing the +30 dBm pushbutton. This safety interlock helps to prevent accidental high level signal application to sensitive circuits. With the +30 dBm interlock switch on, no output will be obtained on the lower ranges, thus making it impossible to use lower ranges without turning the interlock back off after using the high range. Also, when using the +30 dBm range, AM is not possible. An interlock will prevent AM modulation.

CAUTION

The generator must be terminated in a 50 ohm impedance on the 10 volt range to avoid excessive power dissipation in the generator. On lower ranges, the generator can be used with other impedances, but the output level meter reading must be corrected.

The RF-808 Signal Generator may be used with an external RF-805 Amplifier unit to get up to ten watts of rf output. The only connection required is a 50 ohm cable, with BNC connectors on each end, between the RF OUTPUT connector of the RF-808 and the RF INPUT connector of the RF-805. Consult the RF-805 Instruction Manual for RF-805 load considerations. The maximum RF-808 rf level required for full output from the RF-805 is 100 millivolts (0.1 volt).

3.3 INITIAL TURN ON.

Prepare the signal generator for local operation as follows:

a. Check line voltage, and install fuses of the proper values for either 115V or 230V operation in MAIN and OVEN fuse holders (figures 3-1).

b. Set 115/230V selector (rear panel) for the proper line voltage, using the blade of a small screwdriver as a key.

c. At rear panel, set FREQ STD selector to INT and AM selector to AC.

d. At front panel, depress CW (MODULATION) pushbutton, OFF (SWEEP) pushbutton, and one of the lower range OUTPUT LEVEL attenuator pushbuttons. Turn VARIABLE (OUTPUT LEVEL) control down toward the counterclockwise end. Depress bottom of POWER switch rocker arm.

e. Plug in the line cord, and allow several minutes for initial warm up of the frequency standard.

3.4 GENERAL OPERATION.

a. Turn on POWER switch by depressing top of rocker arm. Rocker arm should illuminate.

b. Set digital frequency knobs to desired integral 1 kHz frequency (or to the nearest 1 kHz increment below desired frequency if VERNIER is to be used for interpolation). READY indicator will illuminate to indicate that frequency is locked to the frequency standard.

c. For frequencies between synthesized 1 kHz steps, use VERNIER interpolation as follows to add from 0 to 1000 Hz to the basic frequency. Depress VERN (SWEEP) pushbutton to activate vernier function. Depress CALIBRATE ON/OFF pushbutton once to turn calibrator on. Set the VERNIER dial to indicate 000 and adjust the CALIBRATE knob for a zero beat indication on the OUTPUT VOLTS meter produced by beating the VERNIER oscillator against a signal that is phase-locked to the frequency standard. It is possible to have a zero beat indication for frequencies that are $\pm$ 100 Hz from the true zero frequency. To eliminate this ambiguity, the zero beat indication for true zero frequency of the vernier (000) was made stronger than the 100 Hz zero beats. Be sure the strongest zero beat indication is used when calibrating with the vernier set to 000. Now set the vernier dial to the 100 Hz increment nearest the desired frequency, and rezero, if necessary, using the CALIBRATE knob. Only a slight adjustment should be required

since the vernier oscillator is typically accurate to ± 1 Hz over the full 1000 Hz range after being calibrated at 000. Turn off calibrator by depressing CALIBRATE ON/OFF pushbutton a second time. The vernier oscillator is now calibrated to within 1 Hz for the adjacent ± 50 Hz range. Set VERNIER dial to desired 1 Hz frequency. To disable VERNIER when it is desired to go back to a locked 1 kHz mode, depress OFF (SWEEP) pushbutton.

d. Depress OUTPUT LEVEL pushbutton corresponding to desired output range.

e. Connect coaxial cable from the RF OUTPUT connector to the circuit under test. Use a blocking capacitor in series with the center conductor if the circuit has dc applied. Also use a blocking capacitor in series with the shield if the common connection of the test circuit is not at ground potential.

CAUTION

The generator must be terminated in a 50 ohm impedance on the 10 volt range to avoid excessive power dissipation in the generator. On lower ranges, the generator can be used with other impedances, but the output level meter reading must be corrected.

f. For +30 dBm (10 volt) output range, set +30 dBm interlock to ON in addition to depressing +30 dBm output level pushbutton. For lower ranges, the interlock must be turned OFF.

g. Adjust VARIABLE level control for desired output level as indicated on the meter.

3.5 MODULATION.

3.5.1 General.

The following paragraphs describe operation required in addition to that in paragraph 3.4 in order to modulate the output signal in amplitude, frequency, or in a pulse mode. For no modulation the CW (MODULATION) pushbutton should be depressed. The controls described in the following procedure are in the MODULATION section of the front panel unless otherwise specified.

3.5.2 AM Mode.

a. Depress AM pushbutton.

b. Select 1000 Hz, 400 Hz, or external modulation by depressing the appropriate pushbutton.

c. For external modulation, connect audio source to MOD IN/OUT connector. 7 volts peak-to-peak is required for full modulation.

d. Adjust MOD LEVEL control for desired modulation percentage, as indicated on meter.

3.5.3 FM Mode.

a. Depress FM pushbutton.

b. Select 1000 Hz, 400 Hz, or external modulation by depressing appropriate pushbutton.

c. Set FM DEVIATION – KHZ selector to 5, 15, 75, or 375 kHz deviation range. This sets both the fm modulation circuits and the meter range.

d. For external modulation, connect audio source to MOD IN/OUT connector. 7 volts peak-to-peak is required for full deviation.

e. Adjust MOD LEVEL control for desired deviation, as indicated on the meter.

NOTE

Deviation limit is ± 375 kHz or the set carrier frequency whichever is less, at rates of 30 Hz to 100 kHz.

To be within specification the lower limit of the deviation must not cause the output frequency to be less than 50 kHz nor the upper limit to be greater than 80 MHz.

3.5.4 Pulse Modulation Mode.

a. Depress PULSE pushbutton.

b. Connect external pulse generator to MOD IN/OUT connector. The MOD LEVEL control is in operative in the PULSE MODE.

c. Set pulse generator for a constant output level of +2 volts dc. This is the level required for keying the RF-808.

d. Set RF-808 OUTPUT LEVEL range and VARIABLE controls for desired output as for normal operation.

e. Set pulse generator for desired pulse characteristics. When keyed on, the RF-808 will now have an output level as set in step d.

3.6 SWEEP.

3.6.1 General.

The following paragraphs outline the operation of the front panel controls to provide AUTOMATIC and MANUAL SWEEP of the output frequency.

3.6.2 Automatic Sweep.

a. Depress AUTO SWEEP pushbutton.

b. Select SWEEP RANGE about desired center frequency by depressing appropriate range pushbutton. (Note that the generator does not provide 0–80 MHz AUTO SWEEP.)

c. Set the AUTO/MANUAL sweep control to the sweep width desired. The fully clockwise position provides the full sweep width, the fully counterclockwise position provides zero sweep width. The outer graduations permit precise selection of sweep widths between the extremes.

d. For variable sweep rates, depress the VAR pushbutton, and set the FAST/SLOW switch and the RATE control for the desired sweep rate.

e. For sweep rates at line frequency, depress the LINE pushbutton. (100 Hz max.)

f. For triggered sweep operation, depress the TRIG pushbutton and connect a positive pulse source of 1 to 4 volts to the EXT TRIG connector on the rear panel.

g. For single sweep operation, with the TRIG button depressed, a single sweep will be generated each time the ONE SHOT pushbutton is activated, the duration being determined by the FAST/SLOW switch and the RATE control. If the ONE SHOT button is depressed during a sweep, the frequency will be reset to that at the beginning of its sweep. This feature is especially useful for early termination and restarting of very slow sweeps.

NOTE

Triggered sweep can be initiated by either the ONE-SHOT button or a positive pulse on the EXT TRIG connector. Therefore, to avoid false triggering, only one of the above trigger sources should be active at any one time.

3.6.3 Manual Sweep.

a. Depress MAN SWEEP pushbutton.

b. Select SWEEP RANGE desired by depressing appropriate range pushbutton.

c. Set the AUTO/MANUAL sweep control to the frequency shift desired. With the outer zero marker aligned with the index, the generator output frequency is as selected on the digital frequency controls. When fully clockwise, the output frequency is shifted to the upper limit of the RANGE selected; when fully counterclockwise, the output frequency is shifted to the lower limit of the RANGE selected. With 0–80 MHz RANGE selected, the frequency controls should all be set to zero. The output frequency of the generator is then determined by the position of the AUTO/MANUAL SWEEP control, and the inner 0–80 scale provides a reading of the output frequency.

3.6.4 Manual Sweep Calibration.

a. Depress the MAN SWEEP pushbutton.

b. Select the desired SWEEP RANGE. There is no calibration for the 0–80 MHz range.

c. Depress the CAL ON/OFF pushbutton once to activate the calibration circuitry.

d. Set the OUTPUT LEVEL meter to approximately mid-scale.

e. Rotate the AUTO/MANUAL SWEEP control slowly about the zero position until a zero beat is indicated by a slowly pulsating deflection of the OUTPUT METER reading.

f. Adjust the MAN cursor until its index mark is aligned with the zero mark on the AUTO/MANUAL SWEEP control.

g. Disengage the calibration circuitry by depressing the CAL ON/OFF button once more to release it.

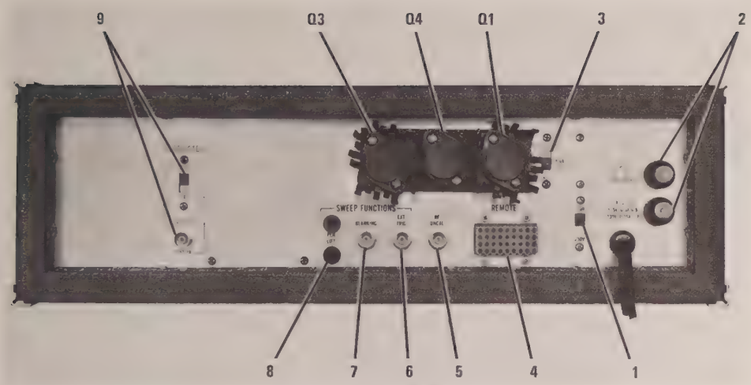
NOTE

In all SWEEP modes, care must be taken that the instantaneous output frequency does not fall below 50 kHz, if operation is desired within the specifications. For the 0–80 MHz MANUAL SWEEP mode, the lower limit is 1 MHz.

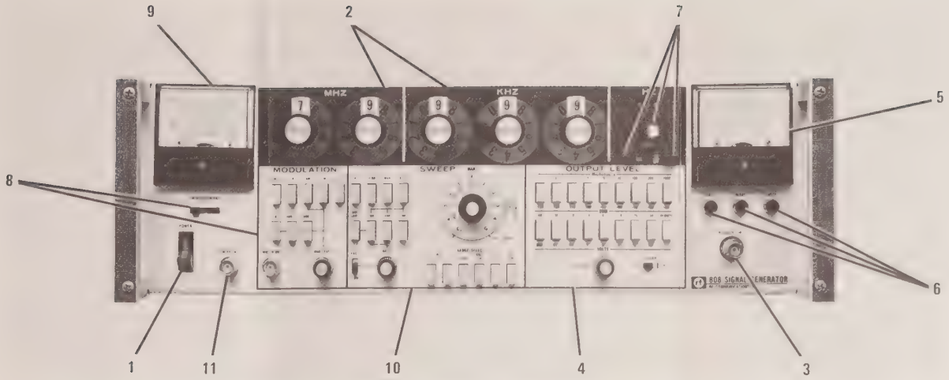
3.6.5 Vernier.

a. Depress the VERN pushbutton and rotate the VERNIER control to display the desired reading in the HZ window.

b. To calibrate the VERNIER, set the VERNIER control to a HZ reading of zero. Set the OUTPUT METER to approximately mid-scale. Depress the CAL ON/OFF button once and rotate the CAL control until zero beat is indicated by a slow pulsation in the OUTPUT METER reading. If more than one beat is obtained, the one giving the greatest deflection is the correct one. Further beats will then be obtained at each multiple of 100 Hz, necessitating only minor adjustment of the CAL control. Disengage the calibration circuitry by depressing the CAL ON/OFF button once more to release it.



REAR PANEL DEVICES



FRONT PANEL DEVICES

1. 115V/230V Selector: Slide switch operated by using a flat blade screwdriver as a key to select proper power supply connections for available line voltage.

2. MAIN Fuse and OVENS Fuse: Holders for type 3AG, slow-blow fuses. Current ratings should be as marked on panel for available line voltage. OVENS fuse protects 24 volt circuits, which are live whenever the unit is plugged in to keep all ovens heated. MAIN fuse protects all power supplies.

3. AM Selector: Controls amplitude modulation function of generator. AC position allows audio brought in through the front panel MOD IN/OUT connector to amplitude modulate. DC/REMOTE position allows an external dc signal brought in through a REMOTE connector pin to exert analog control of the rf output level of the generator.

4. REMOTE Connector: Provides connections for remote control of frequency, level, and modulation. Refer to Chapter 4 for details.

5. RF UNCAL Connector (BNC): Auxiliary rf output with same frequency as main output.

6. EXT TRIG Connector (BNC): Jack for external sweep trigger input. Level should be +1V min., +3V max. Input impedance is 500 ohms. Maximum trigger repetition rate is 100 pulses per second.

7. BLANKING Connector (BNC): Jack to provide blanking pulse for use with external oscilloscope or recording device. Level is approximately +24V behind 6.8K ohms during blanking, –0.2V during sweep.

8. PEN LIFT Connector: (Dual banana jack) Provides pen-lift command to an X–Y chart recorder. Output is dry relay-contact closure between terminals during sweep and open during retrace.

9. FREQ STD Connector and Selector: BNC jack for input or output of a 1 MHz standard signal. With the selector in the INT position, the synthesizer is controlled by the internal frequency standard, and this signal is available at the connector to drive other equipment, such as another RF-808 Signal Generator. With the selector in the EXT position, the synthesizer is controlled by the 1 MHz input from an external standard.

1. POWER Switch: Depress top part to turn on power. Rocker arm lights when power is on. Oscillator ovens are always on, regardless of switch position.

2. Digital Frequency Controls: Sets synthesizer for carrier frequency or center frequency for FM or sweep, except on 0–80 MHz sweep. Automatic dial transfer carries one to next higher digit when changing between "9" and "0" in either direction.

3. RF OUTPUT 50Ω Connector (BNC): Jack for rf output to circuit or unit being tested or to RF-805 Amplifier unit. Use with 50 ohm load circuit through 50 ohm cable, such as RG-58/U, for best operation.

4. OUTPUT LEVEL Controls:

   Attenuator pushbuttons select full range output level in 10 dB steps, calibrated in dBm and microvolts or volts.
   REMOTE pushbutton transfers control to remote input for external output level programming.
   +30 dBm - ON/OFF Safety switch is interlocked to allow +30 dBm or 10 volt range to be selected; must be ON for 10 volt range, must be OFF for lower ranges.
   VARIABLE control sets level into attenuator and, thus, level within selected full meter range from zero to full output of range selected.

5. Output Meter: Indicates variable level of rf output by measuring input to attenuator. Full scale level is marked at selected attenuator pushbutton. Calibrated in dBm and microvolts or volts. Indicated output is accurate only when generator is terminated with a 50 ohm load. Meter is also used as a "beat" indicator for calibration of manual sweep and vernier modes.

6. Status Indicator Lights:

   CAL indicator lights to indicate that vernier/sweep calibrate circuit is in operation.
   READY indicator lights when synthesizer phase lock loops are locked.
   SWEEP indicator reminds operator that generator is in one of the sweep modes.

7. VERNIER Controls:

   Vernier HZ Control sets frequency from 0 to 1000 Hz above that selected by digital controls. Active only when VERN sweep pushbutton is depressed.
   CALIBRATE control is used to calibrate vernier to frequency standard at 100 Hz increments.
   CALIBRATE ON/OFF pushbutton is depressed once to turn on calibrator circuit, and it is depressed a second time to turn circuit off. When ON, CAL light is on and output meter is switched to indicate "zero beat" of calibrate circuit.

8. MODULATION Controls/Connectors:

   CW, AM, FM, PULSE Pushbuttons select mode of modulation. CW is unmodulated carrier. (AM is not available in +30 dBm RF output range.)
   REMOTE pushbutton allows mode to be selected by external programming.
   1000, 400~, EXT Pushbuttons select audio source for AM or FM modulation modes, either 400 or 1000 Hz internal tone generator or audio from an external source.
   MOD LEVEL Control sets the level of modulation.
   MOD IN/OUT Connector allows external audio to modulate in AM or FM or external pulse to be applied to pulse modulator in PULSE mode. When internal tones are used for AM or FM, tones are present at this connector for external use.
   FM DEVIATION – KHZ Selector sets the response of the fm modulator and the meter circuit for operation with a maximum deviation of ± 5, ± 15, ± 75, or ± 375 kHz

9. Modulation Meter: Indicates am modulation from 0 to 100% and fm modulation from zero to a maximum range of ± 5, ± 15, ± 75, or ± 375 kHz.

10. SWEEP Controls:

    MANUAL/AUTO RANGE Control sets the frequency output of the generator in MANUAL sweep mode and sets the range of sweep from 0 to 100% of selected range in AUTO sweep mode.
    CAL lever on side of control calibrates the MANUAL/AUTO RANGE Control for MANUAL sweep mode by moving the center cursor line above the control knob.
    0–80 MHz pushbutton selects "full" or "video" sweep ie., sweep from 1 MHz upward to a maximum of 80 MHz.
    ± 5 MHz, ± 500 kHz, ± 50 kHz, ± 5 kHz, and ± 500 Hz pushbuttons select ranges for manual or automatic sweep around the center frequency set on the digital controls above.
    RATE Control and FAST/SLOW Selector control the sweep rate for automatic sweep.
    OFF pushbutton disables sweep function for fully synthesized signal generator operation.
    VERNIER pushbutton enables VERNIER 0 to 1000 Hz frequency control.
    MAN pushbutton selects manual sweep operation, with the output frequency controlled by the MANUAL/AUTO RANGE Control.
    AUTO pushbutton selects automatic sweep with one of the following trigger modes.
    LINE pushbutton selects sweep at the repetition rate of the line frequency independent of rate controls.
    VAR pushbutton selects variable or free-running sweep operation, with the sweep time and repetition rate both controlled by the RATE controls.
    TRIG pushbutton selects sync triggering by an external trigger generator. The ramp length or time of sweep is still controlled by the RATE control and FAST/SLOW selector.
    ONE SHOT pushbutton selects a mode in which the frequency is constant at the lower sweep limit until the generator sweep is triggered by depressing this button Each time it is depressed, one sweep will occur at a time set by the RATE control and FAST/SLOW selector.

11. SWEEP OUT Connector (BNC): Jack for sweep output to an oscilloscope or X–Y recorder. Output level is nominally –5 to +5 volts (swept).

Figure 3-1. RF-808 Signal Generator; Controls, Indicators and Connectors

CHAPTER 4

REMOTE PROGRAMMING

4.1 GENERAL.

Three major functions of the RF-808 Signal Generator may be remotely programmed. These are output level, frequency, and modulation mode. Remote programming is accomplished through the rear panel REMOTE connector (figure 4.1) by means of a computer-compatible binary code. Thus, the functions of the digital frequency controls and the MODULATION and OUTPUT LEVEL pushbuttons can be performed remotely. In addition, analog remote signals can be applied to duplicate the effects of the VERNIER frequency control and the VARIABLE output level control. With the use of external D/A converters, these latter two functions may also be controlled in steps by digital signals.

4.2 LOGIC LEVELS.

The digitally controlled functions of the RF-808 have an interface which is compatible with standard positive-true RTL, DTL or TTL computer logic circuits.

For purposes of allowing design of control devices other than the above forms of logic the required input levels are defined as follows. Logic "1" is +3.3 to 6.3 volts. This can be a contact closure to the 3.6 volts which is available at the REMOTE connector. Logic "0" is 0.0 ± 0.5 volts. This logic "0" level can be provided by an open circuit to the logic line or by a contact closure connecting the logic line to the common ground.

4.3 FREQUENCY PROGRAMMING.

Each of the five decade frequency ranges (10's of MHz to 1's of kHz) may be separately controlled. The digit of the range is selected by BCD code, 1, 2, 4, 8.

Frequency coding uses 19 leads plus a common lead used by all of the functions that are binary coded. To remotely program one or more frequency decades, the appropriate knobs on the front panel must be set to zero. Decades whose knobs are not set to zero and/or whose remote programming leads are not used will produce an output as set by the front panel knobs. Thus, some decades may be set manually from the front panel; with the remainder being remotely programmed as desired using coded leads as shown in table 4-1.

The vernier frequency function uses an analog input signal of 0 to +1.2 volts to vary the frequency from 0 to 1000 Hz above the digitally set (integral 1 kHz) frequency.

4.4 OUTPUT LEVEL PROGRAMMING.

The signal output level of the RF-808 may be remotely adjusted in 10 dB steps by binary code 1, 2, 4, 8, 16. A count of "zero" corresponds to −130 dBm or 0.1 microvolt, a count of "one" corresponds to −120 dBm, a count of "two" corresponds to −110 dBm, etc. Each count higher corresponds to 10 dB more output up to a count of 16, corresponding to +30 dBm. In order to use remote output level selection, the REMOTE output level pushbutton must be depressed.

Output level may be adjusted between these ten dB steps with a vernier analog control over a 30 dB range. This is accomplished by applying 0 to +3.0 volts dc to pin 1 in the REMOTE connector from a source capable of furnishing 3.5 ma. If desired, an external digital to analog converter can be used with steps as fine as 0.1 dB or finer over a 10 dB range as limited by the external converter type. To allow vernier output control, the rear panel AM selector (figure 3-1) must be set to DC/REMOTE. Power for an external vernier control can be obtained from the attenuator B + bus, pin 9 of the REMOTE connector.

4.5 MODULATION PROGRAMMING.

Am and fm modulation modes and internal 400 or 1000 Hz tones or external modulation input may be selected by applying a logic "1" to the appropriate input lines (table 4-1). To use this feature, one mode (am or fm) should be actuated and one audio source should be selected. B + for logic "1" can be obtained from pin 18, (+3.6 VDC).

When using internal modulation, the MOD LEVEL control should be preset for a fixed am modulation level or fm deviation, then turned on or off with the appropriate remote control line. With external modulation, the modulation level or deviation may be varied by adjusting the audio input level. 95% am modulation is achieved with 7 volts peak-to-peak external modulation signal at the MOD IN/OUT connector. Full fm deviation on each range of the meter is accomplished with 7 volts peak-to-peak modulation input.

NOTE

Amplitude modulation may not be used simultaneously with the +30 dBm RF output range.

4.6 INTERFACE CONVERTERS.

Simple decimal to binary logic converters (solid state or contact type) can be used to convert digits (decimal) information to the binary code required for the generator. Thus the RF-808 may be easily used as a replacement item in already existing systems where interfaces were previously established. Because BCD is the most commonly used automatic control interfacing for this type of equipment, the RF-808 gives the user maximum versatility at minimum cost in automatically programmed applications.

4.7 CONNECTOR.

The mating plug for the REMOTE connector may be purchased from Molex Products Company; 5224 Katrine Avenue; Downers Grove, Illinois 60515. One part number 1772-36P shell is required plus 36 each of either part number 1560-T (Crimp Pins for No. 18-22 wire) or part number 1804-T (Solder Pins). The complete connector Kit may also be purchased from RF Communications as Part number PX028081.

TABLE 4-1. REMOTE CONNECTOR PIN FUNCTIONS.

FUNCTION	CODE	PIN NOs.
10 MHz Decade	1, 2, 4,	28, 11, 12
1 MHz Decade	1, 2, 4, 8	29, 30, 24, 32
100 kHz Decade	1, 2, 4, 8	31, 19, 22, 13
10 kHz Decade	1, 2, 4, 8	20, 23, 10, 21
1 kHz Decade	1, 2, 4, 8	35, 36, 33, 34
+3.6 vdc Decade B + Output 100 ohm source	– –	4
Vernier-Frequency Mode	–	15
Output Level in 10 dB Steps	1, 2, 4, 8, 16	7, 6, 5, 14, 8
+3.6 vdc Attenuator B + Output (Switched) 470 ohm source	– –	9
Fm Mode	–	16
Am Mode	– –	17
Internal 400 Hz Audio On	– –	26
Internal 1000 Hz Audio On	– –	25
External Audio Input On	– –	27
+3.6 vdc Modulation B+ Output (Switched) 680 ohm source	–	18
0 to +2.7 vdc Variable Output Level Control	– –	1
0 to 1000 Hz Vernier Frequency Control	– –	2
Modulation Mode, Variable Output Level Control, and Vernier Freq. Control Common Grd.	– –	3

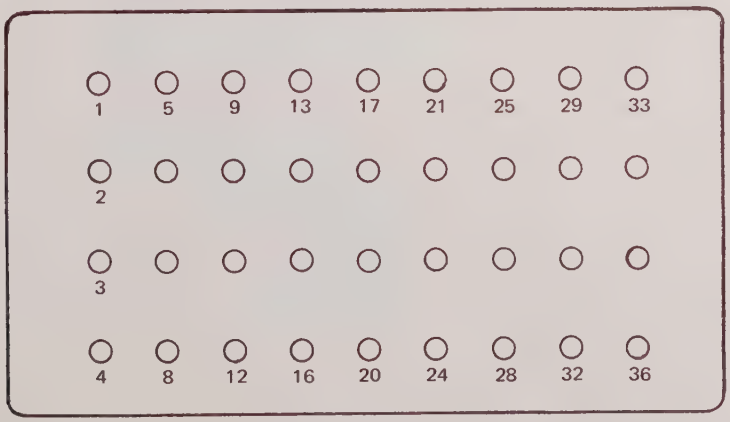


Figure 4.1. Remote Connector Pin Identification, Rear Panel View.

CHAPTER 5
TROUBLESHOOTING

5.1 INTRODUCTION.

This chapter provides instructions and information to (1) remove and replace modules and printed circuit board assemblies, (2) perform equipment performance tests and (3) troubleshoot the equipment. In addition, this chapter contains block diagram analysis of the operation of the frequency synthesizer and important individual circuit sections.

5.2 REFERENCE DESIGNATIONS.

Table 5-1 lists the modules and assemblies which comprise the RF-808 Signal Generator.

TABLE 5-1. LIST OF MODULES AND ASSEMBLIES

REFERENCE DESIGNATOR	FUNCTIONAL NAME
A1	Digital Transfer Mechanism
A2	Vernier Assembly
A3	Sweep Buffer PC Board
A4	Attenuator Switch Assembly
A5	Modulation/Sweep PC Board
A6	Low Speed Divider PC Board
A7	High Speed Divider PC Board
A8	20–30 MHz Oscillator PC Board
A9	Sweep/Sample and Hold PC Board
A10	20 MHz PLL PC Board
A11	20 MHz Sweep PC Board
A12	Attenuator Assembly
A13	Power Supply Regulator PC Board
A14	VHF Loop A module
A15	VHF Loop B module
A16	Discriminator PC Board
A17	Mixer/Divider PC Board
A18	AM Output Loops PC Board
A19	Output Amplifier Module
A20	Standard Divider PC Board
A21	Frequency Standard Module

5.3 MODULE AND PC BOARD REMOVAL PROCEDURES.

5.3.1 General.

Modules and printed circuit board assemblies (figure 5-1) may be extended from the RF-808 main frame to facilitate testing and troubleshooting procedures. To remove and replace modules and printed circuit board assemblies follow procedures given in the following sub-paragraphs.

CAUTION

The 24 volt power supply in the RF-808 is activated whenever the line cord is plugged in. Depending on what work must be done, it may or may be not advisable to disconnect the power. Keeping the supply energized creates a potential danger to service personnel. However, loss of frequency stability results from disconnecting power to the oscillator. Turning off the POWER switch on the front panel will deactivate the other power supplies to minimize the danger of working on a live instrument.

5.3.2 Main Frame Covers.

a. Removal
To remove the top and bottom main frame covers, remove four screws at rear of main chassis securing the covers to the main frame. Slide the covers to the rear of the main frame and out of the slide guides.

b. Replacement
Reverse the removal procedures to replace the covers.

5.3.4 VHF Loop A Module A14.

a. Removal
(1) Remove main frame top and bottom covers (paragraph 5.3.2).
(2) Remove four screws securing module to main frame (figure 5-2).
(3) Disconnect module coaxial connectors.
(4) Lift module up and out of main frame.

b. Replacement
Reverse the removal procedures to replace the module.

5.3.6 VHF Loop B Module A15 Removal.

a. Removal
(1) Remove main frame top and bottom covers (paragraph 5.3.2).
(2) Remove four screws securing module to main frame (figure 5-2).
(3) Disconnect module coaxial connectors
(4) Lift module up and out of main frame.

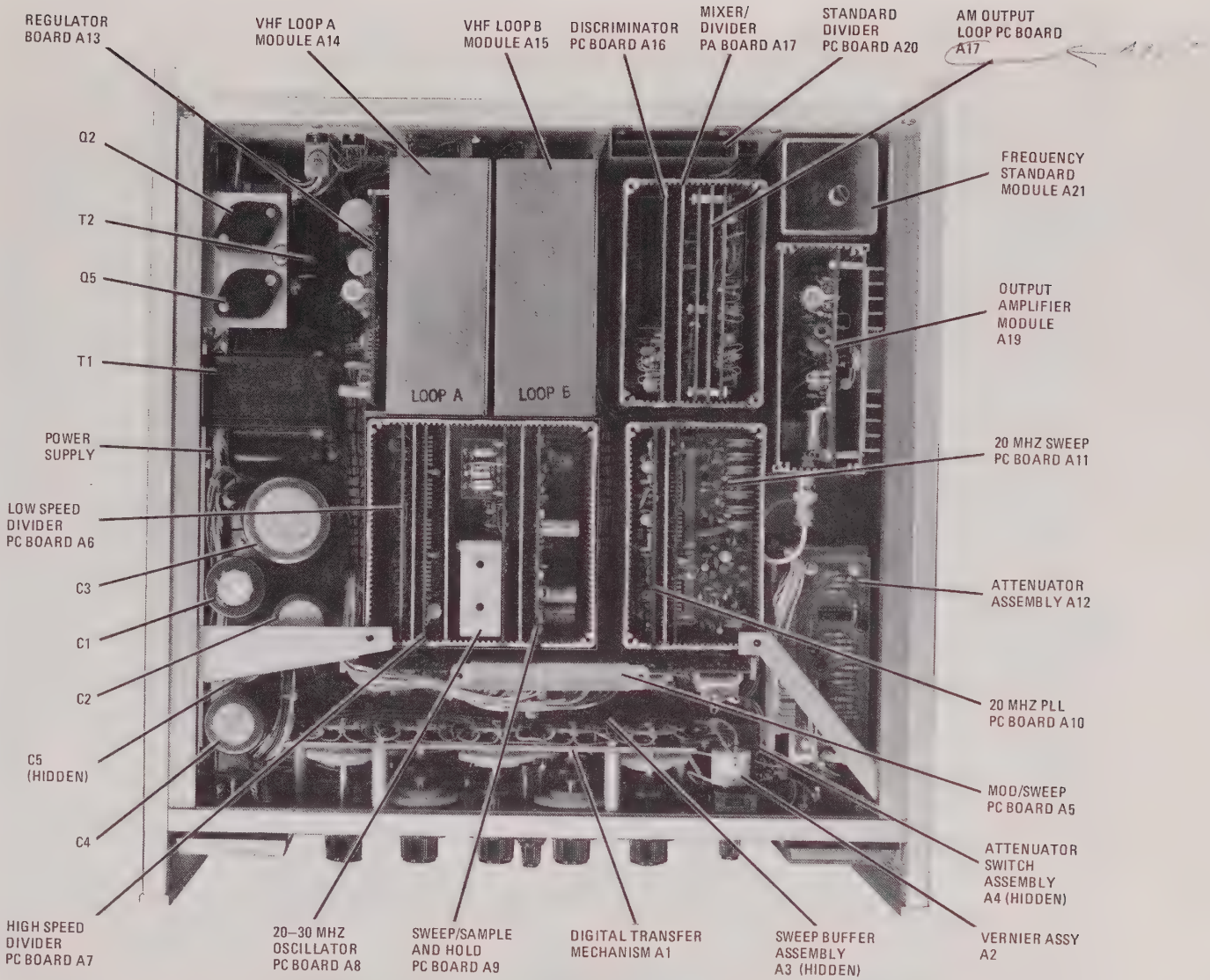


Figure 5-1. RF-808 Top View (Covers Removed).

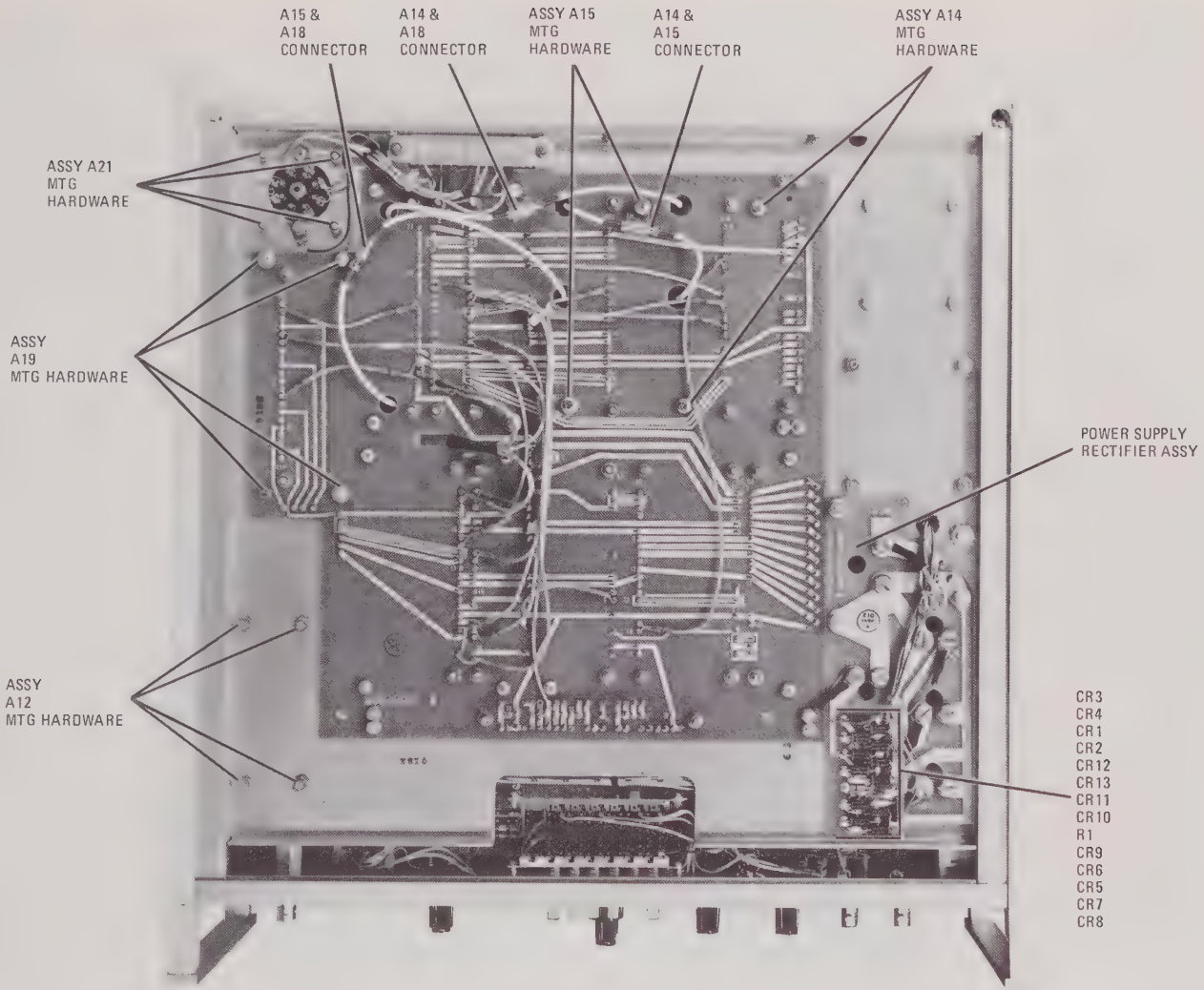


Figure 5-2. RF-808 Bottom View (Covers Removed).

b. Replacement
Reverse the removal procedures to replace the module.

5.3.7 Frequency Standard Module A21.

a. Removal
(1) Remove the main frame top and bottom covers (paragraph 5.3.2).
(2) Remove four screws securing module to main frame (figure 5-2).
(3) Lift module up and out of main frame.

b. Replacement
Reverse the removal procedures to replace the module.

5.3.8 Attenuator Assembly A12.

a. Removal
(1) Remove the main frame top and bottom covers (paragraph 5.3.2) and right hand side cover (paragraph 6.5.1 (2).
(2) Remove screw securing right hand corner bracket to module top.
(3) Remove upper screw securing handle on right hand side.
(4) Remove 2 screws securing rear of upper right hand corner rail, and remove rail.
(5) Remove PC connector from A12, and coax connector from A19.
(6) Remove 3 screws securing attenuator assembly A12 to heat sink, (right hand side).
(7) Remove 4 nuts and lockwashers securing the attenuator to the chassis.
(8) Raise rear portion of attenuator with care to allow threaded studs to clear the holes in the chassis, then slide to the rear to allow the RF OUTPUT connector to clear the front panel.
(9) Remove the attenuator from the unit.

b. Replacement
Reverse the removal procedures to replace the assembly.

5.3.9 Printed Circuit Boards.

CAUTION

The plug-in printed circuit boards are color coded as are the slide guides into which they fit. When replacing the PC boards make sure that the color codes correspond.

a. Removal
(1) Remove main frame top cover (paragraph 5.3.2).
(2) Locate required printed circuit board, figure 5-1. Remove four screws securing printed circuit board assembly cover (not shown) and remove cover.
(3) Use Extractor Tool MP480000 to lift printed circuit board up and out of main frame.

b. Replacement
Reverse the removal procedures to replace the printed circuit boards.

5.4 PRINCIPLES OF OPERATION.

5.4.1 Functional Description.

The frequency synthesizer consists of a 1 MHz frequency standard, a programmed frequency divider, a free-running VHF oscillator, five phase-locked loops, and an error cancelling loop. The net effect of the synthesizer is to process the frequency standard signal and the other signals to form new frequencies which have a stability and accuracy determined only by the frequency standard. The frequencies generated are processed at vhf frequencies using phase-locked oscillators to avoid the high spurious outputs which are characteristic of older synthesizers which use direct hf signals synthesis.

Refer to figure 5-3. The free-running 280–350 MHz vhf oscillator signal (voltage tuned to a 10 MHz increment according to 10 MHz digit selection) is mixed in three progressive phase-locked loops to provide the several required frequency changing functions. The signal from the vhf oscillator is then used in a down converter to mix the vhf synthesizer output down to the 50 kHz to 80 MHz output range. The nature of the two mixing processes which the vhf oscillator signal undergoes results in error cancelling, so that the stability of the output signal is not affected by the vhf oscillator.

One of the phase-locked loops (270–280 MHz) is fed by a separate (20–30 MHz) phase-locked loop controlled by a programmed frequency divider to provide digital frequency selection over a 10 MHz range (according to 1 MHz, 100 kHz, 10 kHz, and 1 kHz digit selection).

The third phase-locked loop (320 MHz) operates in conjunction with the input from the VHF oscillator and a 10 MHz gating pulse signal to provide a signal at 320 MHz which includes the error from the VHF oscillator to allow error cancelling to take place later in the down mixer.

The fourth (300 MHz) phase-locked loop in the signal path normally provides a fixed subtraction of 20 MHz, but the frequency is swept for the symmetrical (less than $\pm$ 5 MHz) sweep modes, for vernier 1 Hz control and for frequency modulation.

A READY lamp illuminates to indicate that the 20–30 MHz synthesizer is locked. This function is accomplished by a logic circuit with an "out-of-lock" input from the 20–30 MHz phase-locked loop.

Audio modulation and variable level control and output leveling are accomplished by two cascade connected amplitude modulator stages, which are in series with the vhf oscillator signal to the down converter. Pulse modulation is performed by a modulator stage in series with the hf path following the down converter. The hf signal is then amplified to the final level and applied to the load through an attenuator, controlled by binary actuated attenuator sections.

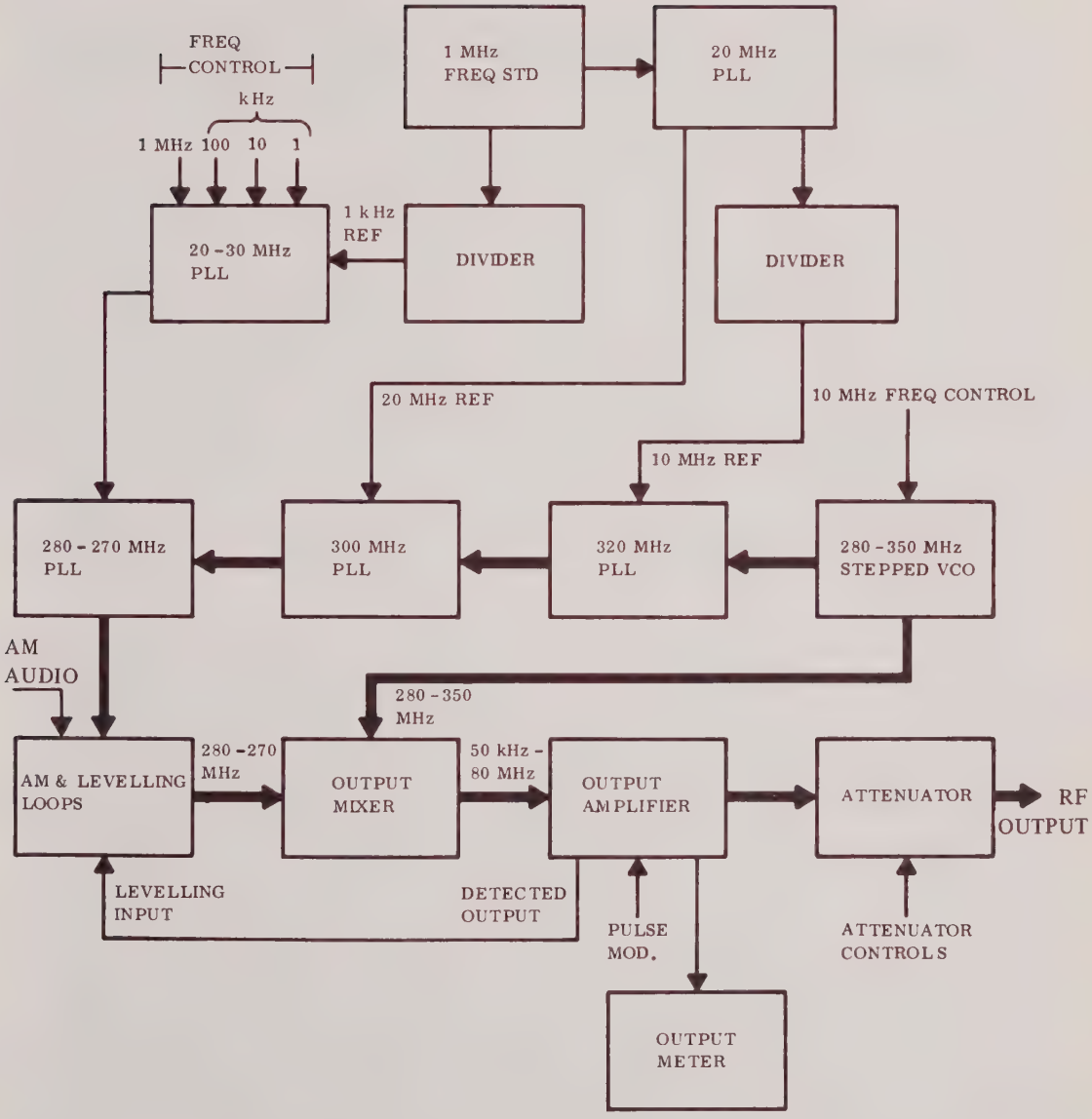


Figure 5-3. Basic Synthesizer Block Diagram, Fully Synthesized Modes Only.

Manual sweep is provided by applying a variable dc voltage from a potentiometer to one of several voltage-controlled oscillators. Automatic sweep is provided by supplying the varying dc voltage from a ramp generator.

5.4.2 Frequency Synthesizer.

The frequency synthesizer generates the radio frequency signal that appears at the output jack of the RF-808. This signal is derived, or "synthesized" by mixing a series of frequencies. These frequencies are maintained in step with, or "locked" to a frequency standard (a 1 MHz signal produced in a highly stable crystal oscillator circuit). In this way the stability of the output frequency is directly tied to that of the frequency standard.

In order to lock an oscillator to a stable frequency source, the oscillator must be capable of changing its frequency to match that of the stable frequency source. The oscillator used has as part of its frequency determining network, a varactor diode, whose capacitance depends on the DC voltage across it. Thus, by varying this DC voltage, the output frequency can be changed. This is a voltage controlled oscillator (VCO). The VCO frequency and the output from a frequency standard are compared in a phase detector. The phase detector produces a DC output voltage which is directly proportional to the difference in phase between them. This DC voltage is then applied to the VCO to change the VCO frequency in the direction which will maintain a constant phase difference, thereby locking the VCO to the stable frequency source. This constitutes a phase-locked loop (PLL). The phase comparison may take place at the fundamental frequencies of both oscillators or at a harmonic or sub-harmonic of either or both. The controlled frequency may first be mixed with another frequency and the difference used in the phase detector. In all instances, the output of the phase detector is applied to the VCO.

Refer to block diagram figure 5-4. The following discussion describes the frequency synthesis scheme with the RF-808 set to the CW mode of operation. The 50 kHz – 80 MHz output frequency is derived via five phase-locked loops (assemblies A6, A7, A8, A9, A10, A14 and A15). The front panel control setting the tens MHz decade presets the 280–350 MHz VCO to 1 of 8 frequencies approximately 10 MHz apart. (It should be noted that this decade oscillator is not phase-locked to any reference and therefore may drift slightly. This drift is later eliminated in the output mixer stage by means of a drift cancelling loop). The output of the 280–350 MHz VCO is mixed with the output of the 320 MHz VCO, resulting in a difference of 0, 10, 20, 30 or 40 MHz depending on the setting of the tens MHz control. The mixer stage output is amplified and applied to a sampling phase detector circuit where it is compared with a 10 MHz reference pulse, that is phase locked to the 1 MHz frequency standard A21. The DC voltage output from the phase-detector is then amplified and applied to the 320 MHz VCO to control the VCO frequency. In the zero frequency condition, the mixer acts as the phase detector to produce a control voltage. This control voltage is processed in the DC amplifier circuit and applied directly to the 320 MHz VCO. The result is a 320 MHz signal that is locked to, and has the same degree of stability as the 280–350 MHz VCO. The 320 MHz signal is in turn mixed with the output of the 300 MHz VCO to produce a nominal 20 MHz output signal. This 20 MHz signal is amplified and compared in a phase detector with a reference 20 MHz signal from 20 MHz PLL A10 that is also phase locked to the frequency standard. The output of the phase detector is used to lock the 300 MHz VCO. Again,

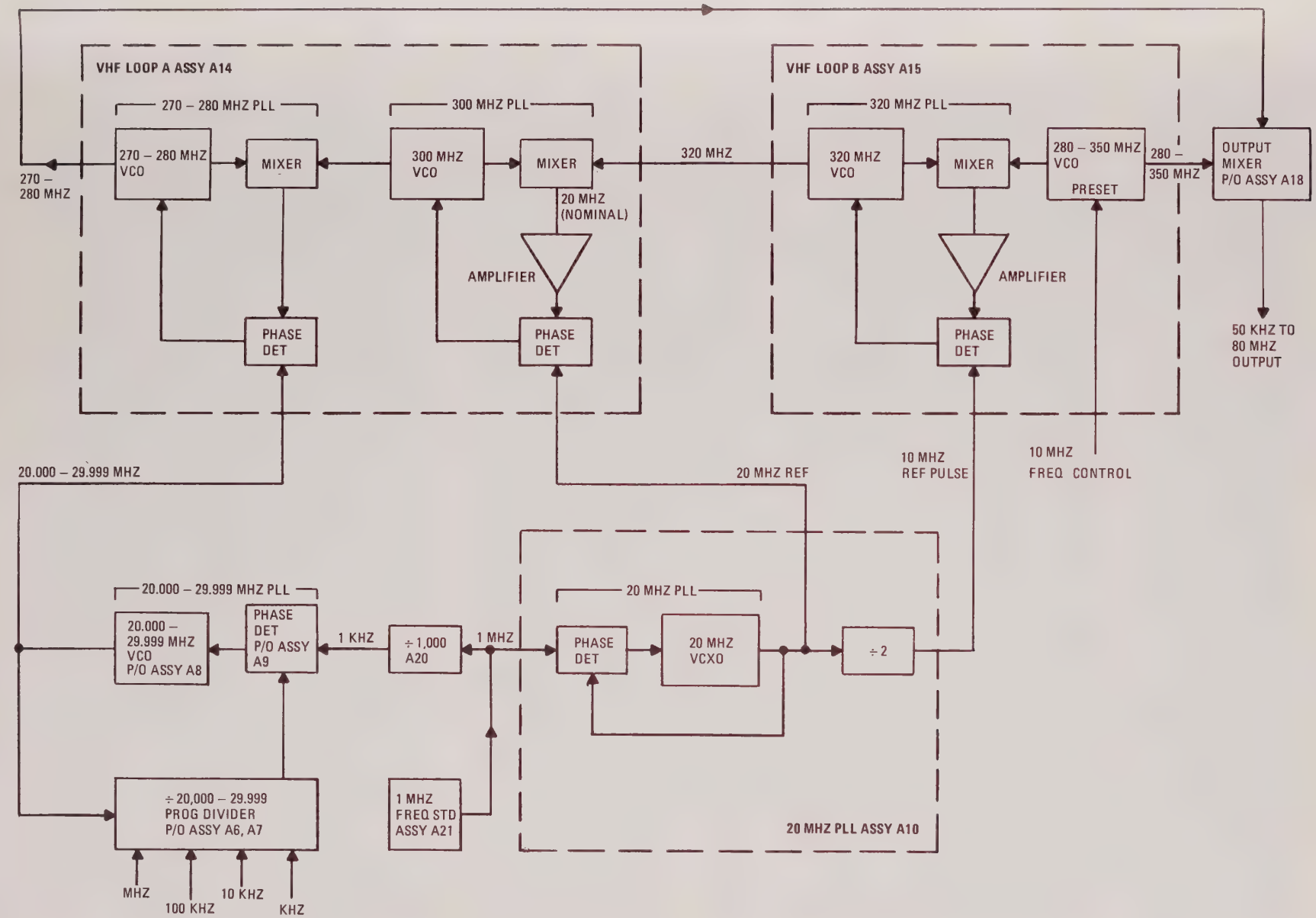


Figure 5-4. Frequency Synthesis Scheme CW Mode, Block Diagram

this 300 MHz signal has the same stability as the 280–350 MHz (unlocked) VCO. The 300 MHz output signal is now mixed with a signal from the 270–280 MHz VCO producing a signal in the 20–30 MHz range. The output of the mixer is then compared in a phase detector, with a reference signal from the 20.000 to 29.999 MHz PLL A6, A7, A8 and A9. The phase detector output voltage locks the 270–280 MHz VCO to the 300 MHz VCO. The signals produced are different from 300 MHz by integral multiples of 1 kHz in frequency and have the same stability as the 280–350 MHz VCO in assembly A15.

The output signal from the VCO on A8, which is in the 20,000 to 29,999 MHz range, is divided down by a factor of 20,000 to 29,999, in the programmable divider circuit (A6, A7) in accordance with the setting of the front panel frequency controls. The output of the programmable divider is a nominal 1 kHz. This 1 kHz signal is compared in phase detector A9 with a phase locked 1 kHz reference signal derived from the 1 MHz frequency standard through a ÷ 1000 circuit on A20. The resultant DC voltage locks the 20.000 to 29.999 MHz VCO. The final step in the frequency synthesizing process is the mixing of the 270–280 MHz, 1 kHz stepped frequency to generate output frequencies in the 50 kHz to 80 MHz range in 1 kHz steps. The two inputs to mixer A18 are locked and have the same instability, which is cancelled in the mixing process. The only remaining instability in the output frequency is that of the 1 MHz frequency standard itself, which is, of course very small. Control circuits in A18 enable the output amplitude to be varied from 0 to 10 volts RMS into a 50-ohm load.

NOTE

If the front panel controls are set to provide output frequencies of less than 50 kHz, the output amplitude will diminish to an unspecified level. It is theoretically possible at this point in the circuit to synthesize frequencies down to zero. Due to frequency response limitations in the amplitude leveling circuit and the output power amplifier, there will be an increase in harmonic distortion and a reduction in output level at frequencies below 50 kHz. The RF-808 specifications apply only for output frequencies from 50 kHz to 80 MHz, although usable outputs are obtained down to 20 kHz.

5.4.3 Sweep Circuits.

The function of the sweep circuits is to control or modify the output frequency relative to that indicated by the front panel controls. Control and/or modification of the signal is necessary when an output frequency lying somewhere between the standard 1 kHz increments is desired, or when the output frequency needs to be varied over a certain range relative to the selected frequency, either manually, or automatically in a repetitive manner.

a. Vernier Mode. Refer to block diagram figure 5-5(A). When the front panel VERN (SWEEP) button is depressed, the phase-locked 20 MHz reference signal from 20 MHz PLL

assembly A10, to the 300 MHz PLL is assembly A14, is replaced by a 20 MHz signal from sweep assembly A11. The frequency of this 20 MHz signal from the sweep assembly can be increased from 20.000 to 20.001 MHz by application of a variable DC voltage across the varactor diode in the 20 MHz VCXO circuit. In turn, this increase in frequency will be reflected in a corresponding increase in the RF-808 output frequency over that indicated on the front panel decade frequency control.

In the vernier mode, depressing the VERN (SWEEP) button applies an enabling voltage to logic and diode gating circuits. The enabling voltage turns on the VCXO in the 20 MHz VCXO assembly (P/O A11). The output of the VCXO is gated through logic circuits in the 20 MHz PLL assembly (P/O A10) and through switching logic circuits in Frequency Discriminator assembly A16 to 300 MHz PLL assembly A14. The variable VCXO control voltage from the VERNIER control is buffered by a unity gain amplifier in Sweep Buffer assembly A3 prior to application to the 20 MHz oscillators.

NOTE

In this mode of operation, the RF-808 output is not fully synthesized, but is stable enough for normal use. The typical drift rate is less than 10 Hz per day.

b. ± 500 Hz and ± 5 kHz Manual Sweep Modes. The preceding discussion (a. above) is applicable to the ± 500 Hz and ± 5 kHz manual modes of operation except that the VCXO control voltage is obtained from the AUTO/MANUAL SWEEP potentiometer.

c. ± 50 kHz and ± 500 kHz Manual Sweep Modes. Refer to block diagram figure 5-5B. In the ± 50 kHz and ± 500 kHz manual sweep modes of operation, the required frequency deviation cannot be obtained from the VCXO (P/O A11A2), and so this oscillator is replaced by a 20 MHz VCO, which is also located in 20 MHz Sweep Assembly A11. In a manner similiar to that for the Vernier mode of operation, an enabling voltage is applied to gating circuits and to the VCO enabling circuits (P/O assembly A11) to turn on the oscillator. (This enabling voltage is connected into the circuit when the ± 50 kHz or ± 500 kHz button is depressed). The output of the VCO is gated through the switching logic circuits in Frequency Discriminator assembly A16 to the 300 MHz PLL Assembly A14.

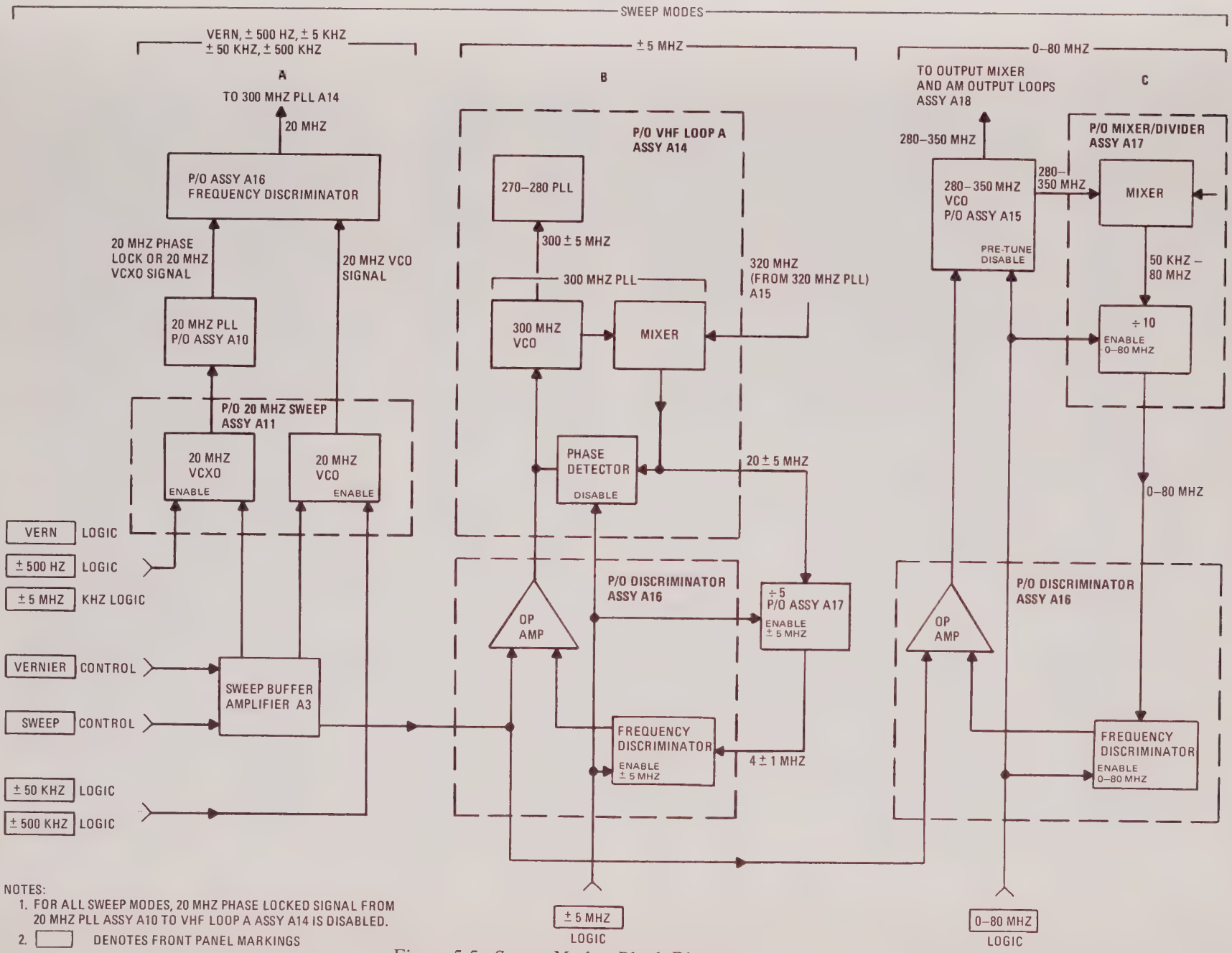
d. ± 5 MHz Manual Sweep Mode. Refer to block diagram, figure 5-5(B). In the ± 5 MHz manual sweep mode of operation, there is no 20 MHz reference injection signal to the 300 MHz PLL. However, when the 300 MHz VCO is exactly 20 MHz below the 320 MHz input signal to the mixer, the mixer output will be 20 MHz. Under these conditions, the RF-808 output will be the frequency indicated by the front panel digital frequency controls. When the ± 5 MHz front panel button is depressed −5.2 volts dc is applied to the divide-by-five circuits (P/O A17), the frequency discriminator (P/O A16) and to the phase detectors (P/O A14). This negative voltage enables the divider and frequency discriminator circuits and disables the phase detector. The 20 MHz signal from the mixer is divided by a factor of five in the divider circuit and the resultant 4 MHz output signal is fed to the frequency discriminator, whose output is 0 volts when the 300 MHz VCO is exactly 300 MHz. The frequency discriminator output and a sweep voltage are applied to the input of an operational amplifier (P/O A16). The voltages are added algebraically in the operational amplifier. The resultant output controls the frequency of the 300 MHz VCO (P/O A14). When the frequency discriminator output voltage and the sweep voltage are both zero, then the 300 MHz VCO frequency is exactly 300 MHz and the RF-808

output corresponds to the frequency control settings. If, now, the SWEEP voltage input to the operational amplifier changes, the frequency locked loop operates to produce an equal but opposite voltage from the frequency discriminator, brought about in turn by a change in the frequency of the 300 MHz VCO. The circuit constants are such that a ± 0.6 volts change in the SWEEP voltage causes a ± 5 MHz change in the frequency of the 300 MHz VCO and consequently a similiar change in the output frequency of the RF-808.

e. 0–80 MHz Sweep Mode. Refer to block diagram figure 5-5(C). In the 0–80 MHz mode of operation, when the 0–80 MHz button is depressed, –5.2 volts DC is applied to gating circuits in the tens MHz oscillator to disable the pre-tuning circuits. The oscillator is then controlled by a frequency locked loop. An arrangement similiar to that used in the ± 5 MHz mode is employed. The outputs of the 280–350 MHz and the 270–280 MHz oscillators (P/O A15 and A17) are mixed in assembly A17. The difference frequency is divided by a factor of 10 in the divide by 10 circuit, which is enabled by the negative voltage on the logic control line, providing an output frequency in the 0–8.0 MHz range. This signal is applied to the frequency discriminator (P/O A16), which has also been enabled by the negative voltage on the logic control line. The frequency discriminator has been adjusted for a zero voltage output when the input frequency is 4 MHz. This corresponds to an RF-808 output frequency of 40 MHz. The frequency discriminator output and the sweep control signal are applied to the input of an operational amplifier (P/O A16). As before, the input voltages are added algebraically and the output is used to control the 280–350 MHz VCO (P/O A15). Thus, as the sweep voltage varies, the frequency locked loops act to produce an equal but opposite voltage from the frequency discriminator and by so doing, bring about a corresponding change in the RF-808 output frequency. A sweep voltage change from –3.0 volts DC to +3.0 volts DC at the output of the sweep buffer amplifier (A3) causes the generator output to change from 1 to 80 MHz.

f. Manual Sweep. Refer to block diagram figure 5-5. In all manual sweep modes the voltage across the AUTO/MANUAL Sweep potentiometer is 1.2 volts DC balanced about ground potential. The voltage at the wiper arm is applied to the sweep buffer amplifier (A3) whose gain is 1 (unity) in the ± 500 Hz, ± 50 kHz, and ± 5 MHz sweep modes, 5 in the 0–80 MHz modes and 10 in the ± 5 kHz and ± 500 kHz sweep modes. Therefore, depending upon the sweep range that is selected, the voltage on the sweep control line may be in the ± 0.6 VDC, ± 3.0 VDC, or ± 6.0 VDC range. The manual sweep control knob is calibrated to indicate directly the deviation from the selected center frequency or the true output frequency for the 0–80 MHz range.

g. Automatic Sweep. Refer to block diagram figure 5-5. In all AUTO SWEEP modes, one side of the AUTO/MANUAL SWEEP potentiometer is grounded. Applied to the other side is a saw tooth wave form, generated by sweep generators in Modulation/Sweep board assembly A5. The gain of Sweep Buffer amplifier A3 is the same for any given AUTO SWEEP range as in the MANUAL SWEEP mode, therefore, the sweep potentiometer will adjust the symmetrical sweep voltage amplitude from 0 volts to a ± 0.6 volts which will correspond to a deviation from selected frequency of zero to plus/minus the full selected range. The "zero" pointer on the AUTO/MANUAL SWEEP dial and 0 and 100% AUTO marks on the front panel give an approximate indication of the width of the frequency sweep. The "zero" pointer gives the actual sweep width in percent of full scale. The 0–80 MHz sweep does not operate in the AUTO mode.



NOTES:
1. FOR ALL SWEEP MODES, 20 MHZ PHASE LOCKED SIGNAL FROM 20 MHZ PLL ASSY A10 TO VHF LOOP A ASSY A14 IS DISABLED.
2. [ ] DENOTES FRONT PANEL MARKINGS

Figure 5-5. Sweep Modes, Block Diagram

5.4.4 Modulation and Sweep Signal Generators.

Modulation/Sweep Assembly A5 contains a Wien Bridge Audio Oscillator, a modulation meter amplifier, a current source, bias source and a sweep generator. The Wien Bridge Audio Oscillator provides the 400 Hz and 1000 Hz audio signals used to modulate the RF output of the signal generator in amplitude or frequency.

Refer to block diagram, figure 5-6. Enabling the selected frequency logic control line by depressing either the 400 Hz or 1000 Hz MODULATION front panel button, switches frequency determining components in the Wien Bridge audio oscillator RC feed-back network. The desired 400 Hz or 1000 Hz audio signal is capacitively coupled to the MOD LEVEL control and through an isolation resistor to the MOD IN/OUT connector jack. (When the EXT MODULATION button is depressed, the audio oscillator is disabled, the isolation resistor is by passed and the audio output line is connected directly to the MOD IN/OUT connector jack). The audio signal from the internal Wien Bridge Oscillator or an external audio signal connected to the MOD IN/OUT jack is applied to the meter amplifier through the MOD LEVEL control. The meter amplifier buffers and rectifies the audio input signal. The resultant DC voltage is used to drive the meter.

In the AM mode of operation, the audio signal is capacitively coupled to the VARIABLE output level control, where it amplitude modulates the signal generator RF output. In the FM mode of operation, the audio signal is connected through the MOD LEVEL control to an operational amplifier on Discriminator assembly A16. The operational amplifier output is applied to the control input of the 20 MHz VCO (P/O A11), thereby frequency modulating the RF output of the signal generator.

The current source on the A5 assembly establishes the voltage across the VARIABLE output level control and so determines the maximum output of the RF-808. The output from the wiper of the control is used as the reference signal in the output amplitude control loop on AM/Output assembly A18 and Output assembly A19.

The sweep generator on assembly A5 varies the RF-808 sweep control voltage, thus changing the frequency of the signal generator output at a linear rate in accordance with the settings of the front panel controls. The bias source provides the +0.6 and −0.6 volt reference levels applied to the ends of the AUTO/MANUAL SWEEP control.

5.4.5 AM Loop and Output Amplifier.

The AM loop and Output Amplifier circuits are contained on AM/OUTPUT LOOP assembly A18 and OUTPUT Amplifier assembly A19. The function of these circuits is to amplitude modulate the 270–280 MHz input signal and to ensure that the signal level at the RF output connector is in accordance with the selected levels, regardless of changes in output frequency.

Refer to block diagram, figure 5-7. The gain of the amplitude modulator stage (P/O A18) is controlled by the DC reference level at the output of Operational Amplifier A18IC1. This level is established by comparing the DC voltage from the VARIABLE level control with the detected output of the amplitude modulator in the operational amplifier stage. Therefore, the output of the amplitude modulator is always proportional to the DC level on the VARIABLE level control. The 270–280 MHz RF Signal from VHF Loop A assembly A14 is modulated in the amplitude stage by the audio signal from Modulation/Sweep assembly A5. The audio signal which is

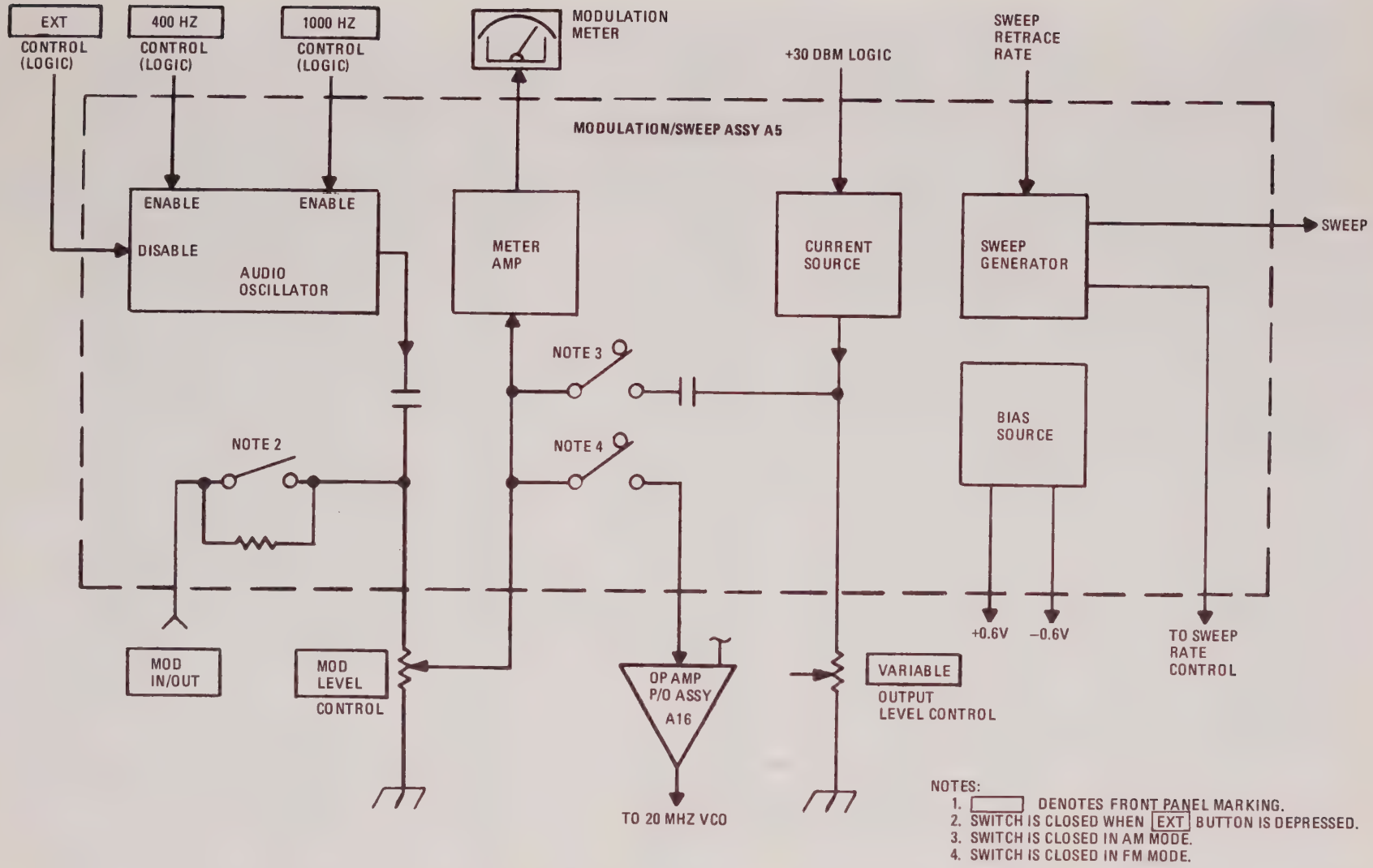


Figure 5-6. Modulation and Sweep Signal Generators, Block Diagram.

capacitively coupled to the VARIABLE level control is taken from the wiper arm of the MOD LEVEL control. The signal from the wiper of the variable level control is applied to the input of A18IC1. This audio signal varies the reference voltage thus varying the control input to the amplitude modulator and in turn modulating the amplitude of the 270–280 MHz signal. The modulated 270–280 MHz signal is applied to the level shifter stage (P/O A18). The gain or loss of this stage is controlled by the DC voltage from the output of Operational Amplifier A18IC2, which compares the detected signal from the output amplifier (P/O A19) with the DC level from the VARIABLE level control. This output loop, in addition to establishing a level for the RF-808 output signal also improves the linearity of the amplitude modulation process.

The 270–280 MHz signal from the level shifter stage is mixed with the 280–350 MHz signal from VHF Loop B assembly A15 to provide an output in the 50 kHz to 80 MHz range. (It should be noted that amplitude modulation occurs at the VHF frequency of 270 to 280 MHz rather than at the output frequency in order to reduce the required modulator band width and to eliminate harmonics of the output frequency). The 50 kHz to 80 MHz from the output mixer stage (P/O A18) is coupled to a pre-amplifier stage (P/O A19) where it is amplified to approximately 4 volts RMS at the maximum setting of the VARIABLE level control. The output of the preamplifier is applied to a fast acting pulse modulator stage (P/O A19) with a typical ON/OFF ratio of 65 dB and with a rise time of 20 nanoseconds. The pulse modulated output is applied to the output amplifier stage (P/O A19) where the signal is amplified to a level of 10 volts RMS in the +30 dBm output range.

The signal generator RF OUTPUT level is also controlled, in addition to the control provided by the variable level potentiometer, by attenuator assembly A19. The attenuator provides a coarse adjustment of the output level and has a range from −130 to +20 dBm, in 10 dB steps. An additional +10 dB (in the +30 dBm output range) is made available by shorting out a 50 ohm termination resistor and increasing the drive to the output amplifier.

5.4.6 FM Mode.

In the FM mode of operation, the phase locked 20 MHz VCXO reference input to the 300 MHz PLL in the synthesizer (figure 5-3) is replaced by a 20 MHz VCO signal that is phase-locked to a 20 MHz reference signal from 20 MHz PLL assembly A10.

Refer to block diagram, figure 5-8. When the MODULATION FM button is depressed, an enabling voltage on the FM logic line is applied to the 20 MHz VCO (P/O A11) and to logic gates in Discriminator Assembly A16. The 20 MHz VCO signal and the 20 MHz reference signal are gated through to identical divider circuits, where they are divided by a factor of 2048. The nominal 10 kHz outputs of the dividers are applied to a phase detector circuit, and the resulting output signal is filtered in a low pass filter circuit and applied to a buffer amplifier stage. The output of the buffer amplifier is coupled to the (−) input of an operational amplifier. The other (+) input to the operational amplifier is the audio modulating signal. The output of the operational amplifier is a control voltage which is fed back to the 20 MHz VCO. When there is no modulation on the audio input line to the operational amplifier, the 20 MHz VCO is locked to the 20 MHz reference signal and the RF-808 output is the frequency set on the front panel frequency controls. When there is audio modulation on the operational amplifier input line, the output voltage of the operational amplifier varies at the audio rate, thereby modulating the frequency of the signal generator.

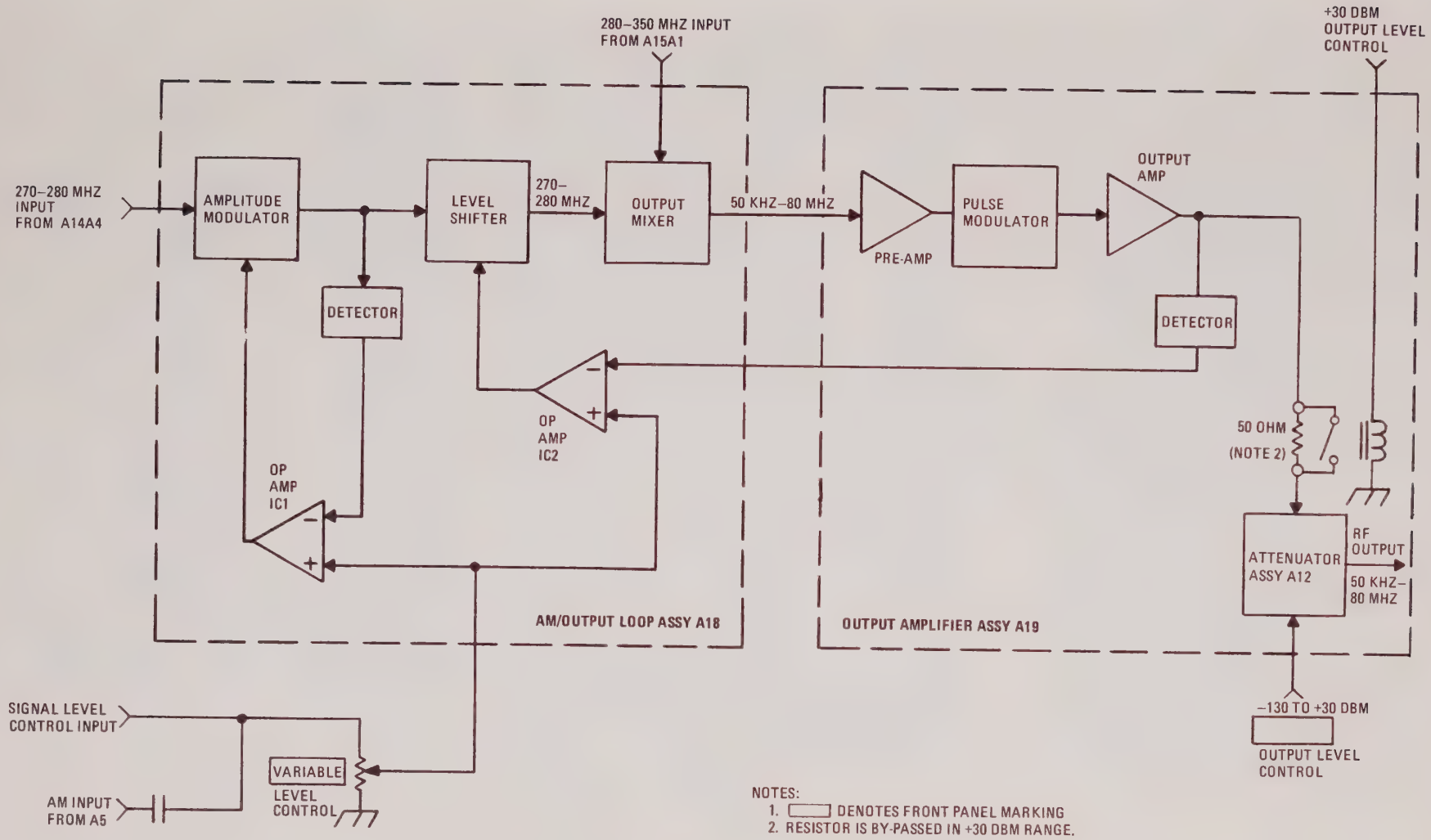


Figure 5-7. AM Loop and Output Amplifier, Block Diagram.

NOTE

When the SWEEP is OFF, the 20 MHz reference signal is obtained from the 20 MHz PLL assembly A10. However, the circuit design is such that if the VERN SWEEP button is depressed the reference signal is obtained from the 20 MHz VCXO assembly. In this mode the center frequency can be shifted over a 1000 Hz range while still in the FM mode of operation. Due to interaction between the 20 MHz VCXO and the 20 MHz LC oscillator in the 20 MHz Sweep Assembly A11, there will be distortion when operating in FM and Vernier modes simultaneously. Therefore operating in both these modes simultaneously is not recommended.

5.4.7 Attenuator Circuits.

The amplitude of the RF-808 output signal can be controlled directly by actuation of push-buttons on the front panel of the unit; or remotely through rear panel connector J1. The push-buttons are mounted on Attenuator Switch assembly A4 and the switched resistive attenuator sections are mounted on attenuator assembly A12.

Refer to block diagram, figure 5-9. The four attenuator sections, 10, 20, 40 and 80 dB can be inserted into the RF-808 output circuit singly or in combination to provide a total attenuation range of 0 to 150 dB in 10 dB steps. The circuit design is such that with 20 dB attenuation, the power dissipated in a 50 ohm resistor connected to the RF OUTPUT connector will be 1 milliwatt or 0 dBm. Consequently, the attenuator pushbuttons are marked in dBm from −130 to +20. When the +30 dBm button is depressed and the +30 dBm switch is ON, the attenuators are bypassed and the RF-808 output power is increased by 4 dB. Simultaneously a 50 ohm series resistor in the output circuit is by passed to provide an additional +6 dB for a total power increase of 10 dB. The +30 dBm switch also functions as a safety device in that two operations are required to obtain the +30 dB output. If both controls are not set properly, the output level will drop to −130 dBm. The VARIABLE output level control is used to adjust the output signal to intermediate levels between the 10 dB steps that are set by the pushbuttons. Used in conjunction with the output level meter the exact, desired output level can be obtained.

The attenuator sections are switched into and out of the circuit by means of four solenoids and associated switches. When the solenoids are not energized, full attenuation is inserted into the circuit. For example, when the 0 dBm button is depressed, 20 dB of attenuation is required. This desired degree of attenuation is obtained by energizing the three relays which control switches S1, S2 and S4. The closed switches by pass the 10, 40 and 80 dB attenuator sections to leave the required 20 dB attenuation in the circuit.

5.4.8 Metering.

The two RF-808 front panel meters indicate signal output levels, amplitude modulation (percentage), and amount of FM deviation in kHz.

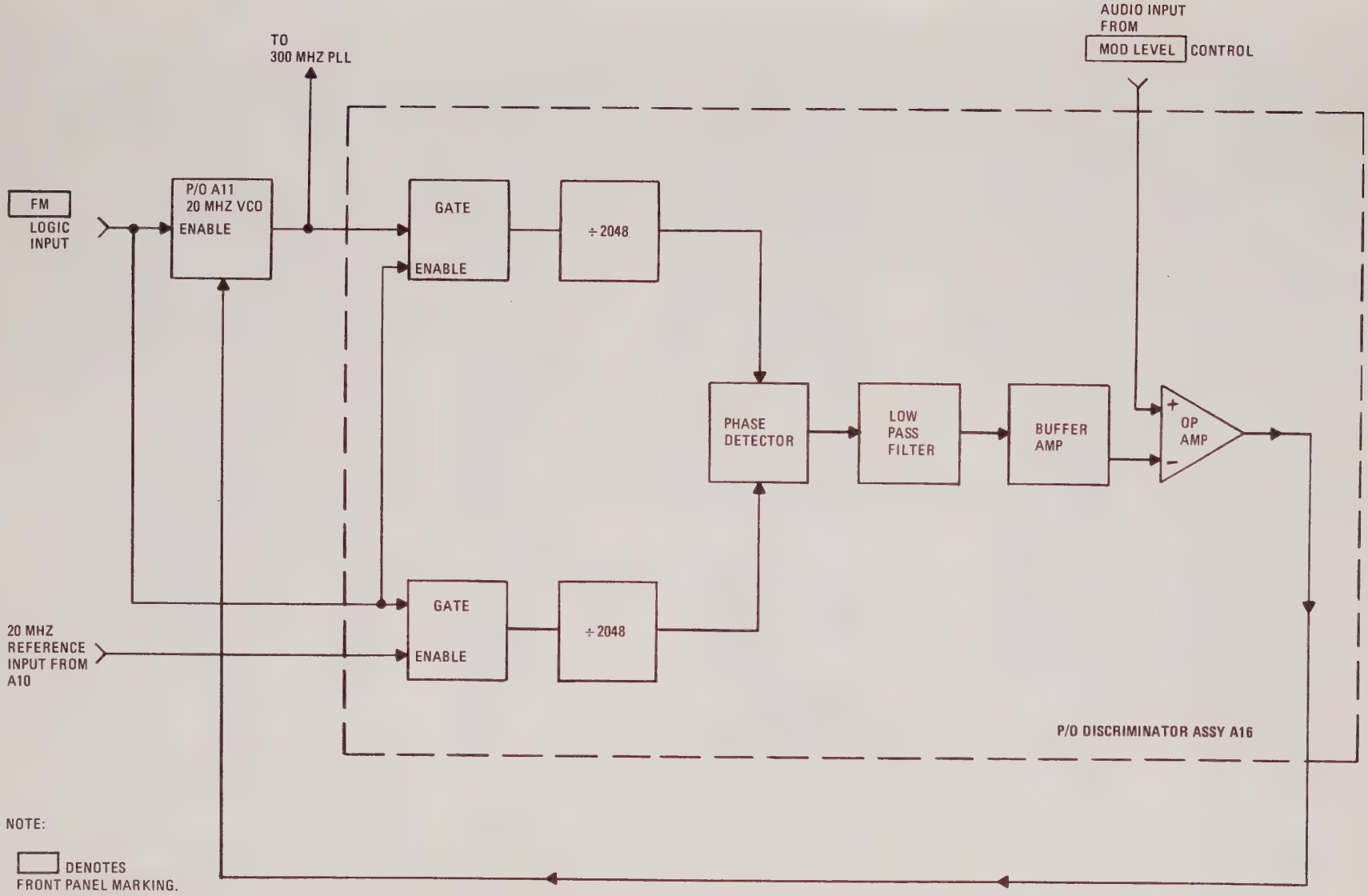


Figure 5-8. FM Mode Operation, Block Diagram.

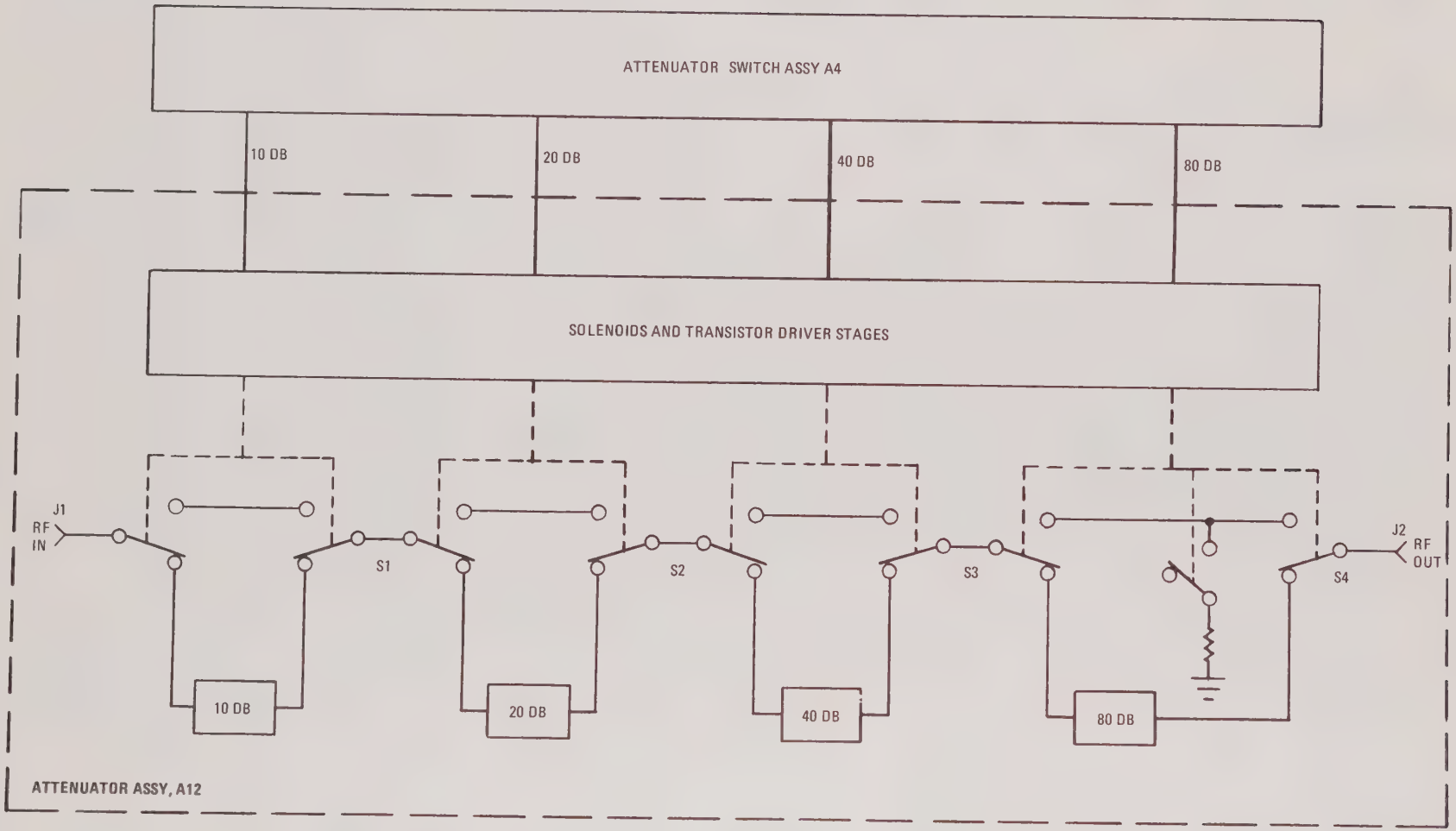


Figure 5-9. Attenuator Circuits, Block Diagram.

a. Output Level Meter. The level of the RF-808 output signal is displayed on the output level meter. Drive for this meter is obtained by rectification of the RF output of the final amplifier in Output Amplifier assembly A19. Two trimmer resistors located on the Attenuator Switch assembly A4 are used to adjust the full-scale reading of the meter. One trimmer resistor covers all ranges up to +20 dBm, for which the output of the final amplifier is constant, the other covers the +30 dBm level where the output is increased by 10 dB. This meter is also used to indicate the 'ZERO BEAT' when calibrating the VERN and MAN SWEEP ranges.

b. Modulation Meter. The amplitude modulation percentage and FM deviation in kHz are displayed on the AMPLITUDE MODULATION and FM DEVIATION meter on the front panel. This audio signal at the wiper arm of the modulation level potentiometer is buffered, rectified and filtered on Modulation/Sweep assembly A5. This DC signal then drives the modulation meter. Calibration of the meter is provided for by an internal trimmer resistor on Modulation/Sweep assembly A5.

5.4.9 Indicator Lamps.

The CAL indicator lamp illuminates when the CAL button is depressed. Depressing the button closes contacts in the switch to provide a ground return for the lamp. The CAL lamp lights to alert the operator that the calibrate mode is activated. The SWEEP indicator lamp operates in the same manner as the CAL lamp, and is used to indicate, when illuminated, that the RF-808 is not in a fully phase-locked mode. The READY lamp is illuminated to indicate that the 20 to 30 MHz loop is locked. The lamp is controlled by a transistor lamp driver what is forward biased to provide a ground return for the lamp. The transistor which is on assembly A12 is controlled by a signal from Sample/Hold assembly A9.

5.4.10 Power Supplies.

The RF-808 power supply contains two primary power transformers, four bridge rectifier circuits and five voltage regulator circuits and supplies the +24 VDC, +3.6 VDC, +12 VDC, −5.2 VDC and −12 VDC required for the operation of the unit. In addition, the 15 VAC output of transformer T1 is half-wave rectified to supply positive pulses for use as a line sweep trigger in the AUTO LINE sweep mode.

Refer to block diagram, figure 5-10. AC power is applied to the primaries of transformers T1 and T2 through a line filter and fuses F1 and F2. (The inputs to the split primaries are connected externally for either 115 VAC or 230 VAC operation). The outputs of T1 and T2 are rectified and filtered to provide the required DC voltage inputs to the regulator circuits. To provide for maximum stabilization of the 1 MHz frequency standard and for oscillator circuits in Sweep assembly A11, transformer T2 which supplies these circuits is energized whenever the unit is connected to a power source. Transformer T2 and its associated circuits constitute an independent power source for the RF-808 +24 VDC supply. When only the +24 volt supply is operative (power ON/OFF switch OFF), a zener diode within the +24 volts DC regulator provides the reference voltage for the regulator. This zener diode is replaced by a more accurate and stable +7.15 volt reference when the power ON/OFF switch is ON and the other power supply circuits are energized. The +7.15 volt DC reference voltage is generated with an integrated circuit that is part of the +3.6 volt DC supply. This reference voltage is also used as a reference for all the other regulated supplies.

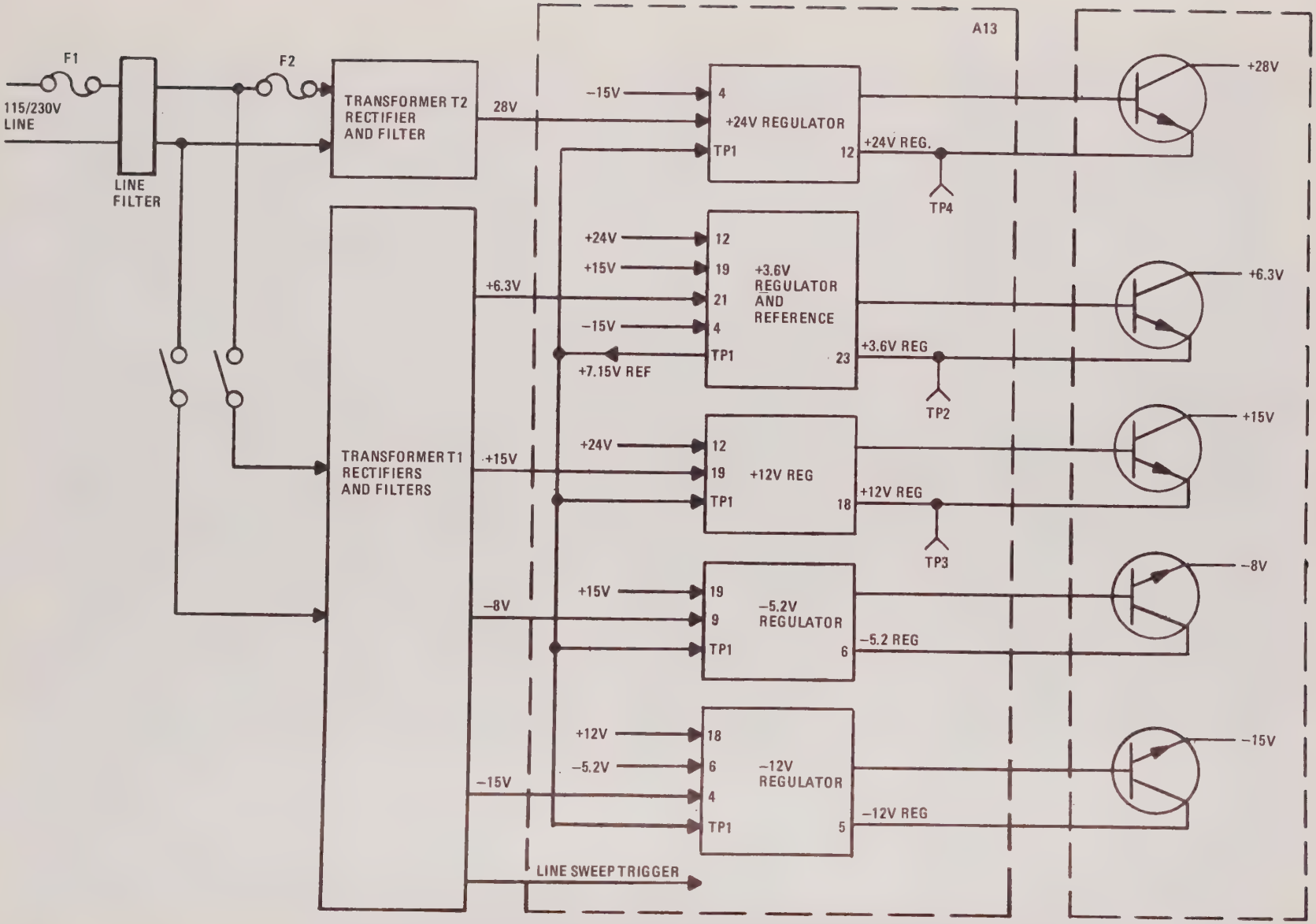


Figure 5-10. Power Supply Circuits, Block Diagram.

The operational amplifiers used in the regulators require external voltages for their operation. As a result, the regulated power supplies are interdependent. For example, the +3.6 VDC supply supply requires +15 VDC, the −5.2 VDC supply requires +15 VDC, the +12 VDC supply requires +24 VDC, and the −12 VDC supply requires both +12 VDC and −5.2 VDC.

5.5 PERFORMANCE TEST.

5.5.1 General.

Following is a relatively quick checkout procedure to ensure that the operating controls have the desired effect for each normal function of the generator. If the unit fails to meet any of the tests and a circuit malfunction is not suspected, refer to the over-all alignment and adjustment procedures of paragraph 6.24. If a circuit malfunction is suspected, refer to the troubleshooting paragraphs. The test equipment required to perform the performance tests are listed below.

CAUTION

The 24 volt power supply in the RF-808 is energized whenever the line cord is connected to a power source. Depending on what work must be done, it may or may not be advisable to disconnect the power. Keeping the supply energized creates a potential danger to service personnel. However, loss of frequency stability results from disconnecting power to the frequency standard oscillator ovens. Turning off the POWER switch on the front panel will de-energize the other supplies to minimize the danger or working on a live instrument.

5.5.2 Test Equipment.

NOTE

The following test equipment or equivalent is required to perform the following Turn-on checks. For overall troubleshooting, the test equipment listed in paragraph 6.3 is required.

a. Frequency counter capable of measurement to 80 MHz.

b. AM/FM Communications Receiver.

c. Dummy load, 50 ohm, 1 watt – Tektronix No. 011-0049-00.

d. RF voltmeter – Hewlett-Packard No. 400F.

5.5.3 Turn on Checks.

a. Perform initial control settings as listed in paragraph 3.3.

b. Depress +10 dBm (OUTPUT LEVEL) pushbutton.

c. Set digital frequency dials to 01.000 MHz.

d. Depress top of POWER switch rocker arm; it should illuminate.

e. After a short time (less than a minute), the READY indicator should illuminate to indicate that the synthesizer is locked to the frequency standard.

f. Depress VERN (SWEEP) pushbutton. SWEEP indicator should illuminate.

g. Depress CALIBRATE ON/OFF (VERNIER) pushbutton once. The CAL indicator should illuminate. Depress a second time to turn if off.

h. Depress OFF (SWEEP) pushbutton to turn SWEEP indicator off.

i. Turn VARIABLE (OUTPUT LEVEL) control through its range. Output meter should indicate over a range of at least 0.3 to 1 volt.

5.5.4 Frequency Selection and Levelling Checks.

a. Set VARIABLE (OUTPUT LEVEL) control for output meter indication of 0.8 volts. During the remaining steps of this paragraph, observe the output meter at each frequency selected to ensure that output levelling maintains the meter indication at a constant level within $\pm$ 0.25 dB.

b. Connect a frequency counter which covers the frequency range up to 80 MHz to the RF OUTPUT connector of the RF-808. Connect the external frequency standard input of the counter to the FREQ STD connector on the rear of the RF-808, and set the counter to operate from the frequency standard in the RF-808. Set the counter for a 1 second sample gate. For each of the following frequency checks, the counter should agree with the selected dial frequency of the RF-808 within one count. Also, each time frequency changes are made, the RF-808 READY indicator should reilluminate.

NOTE

This is not a test of the RF-808 frequency accuracy – only a test of proper synthesizer frequency locking. Therefore, the standard in the RF-808 is used to clock the counter to prevent disagreement in case either standard has a small error.

c. Check for proper counter indication at RF-808 dial frequency settings of 01,000 through 01,009 kHz in 1 kHz steps.

d. Check for proper indications at RF-808 dial frequency settings of 01,000 through 01,090 kHz in 10 kHz steps.

e. Check at settings from 01,100 through 01,900 in 100 kHz steps.

f. Check at settings from 02,000 through 09,000 kHz in 1 MHz steps.

g. Check integral 1 MHz (XX,000 kHz) settings of 10, 19, 20, 29, 30, 39, 40, 49, 50, 59, 60, 69, 70 and 79 MHz.

5.5.5 Sweep Checks.

a. Set RF-808 digital frequency dials for 01,000 kHz.

b. Depress VERN (SWEEP) pushbutton.

c. Depress CALIBRATE ON/OFF (VERNIER) pushbutton once to turn calibrator on.

d. Set VERNIER control to 000 Hz and adjust CALIBRATE control (small knob) for the strongest zero beat indicating true 000. Then set VERNIER control to 100 Hz. Adjust CALIBRATE control (small knob) for exact zero beat indication on output meter. Counter should indicate 01,000.100 kHz within ± 1 count.

e. Repeat step d at 900 Hz and look for 01,000,900 kHz ± 1 count on counter.

f. Depress CALIBRATE ON/OFF (VERNIER) pushbutton to turn off calibrator circuit.

g. Set counter for 100 millisecond sample gate.

h. Depress MAN (SWEEP) pushbutton and ± 500 Hz (RANGE SELECT) pushbutton.

i. Run MANUAL (SWEEP) control through its range. The counter should show that the frequency can be swept over a range of approximately 00,999.5 kHz to 01,000.5 kHz.

j. Depress ± 5 kHz (RANGE SELECT) pushbutton, and repeat manual sweep check. Counter should show frequency sweep over a range of approximately 00,995.0 kHz to 01,005.0 kHz.

k. Depress ± 50 kHz (RANGE SELECT) pushbutton, and repeat manual sweep check. Counter should show frequency sweep over a range of approximately 00,950.0 kHz to 01,050.0 kHz.

l. Depress ± 500 kHz (RANGE SELECT) pushbutton, and repeat manual sweep check. Counter should show frequency sweep over a range of approximately 00,500.0 kHz to 01,500.0 kHz.

m. Set counter for a 1 millisecond sample gate.

n. Set RF-808 digital frequency dials to 10,000 kHz.

o. Depress ± 5 MHz (RANGE SELECT) pushbutton, and repeat manual sweep check. Counter should show frequency sweep over a range of approximately 05,000 kHz to 15,000 kHz.

p. Set FREQUENCY dials to 00000. Depress 0–80 MHz (RANGE SELECT) push-button, and repeat manual sweep check. Counter should shown frequency sweep over a range of at least 02,000 kHz to 80,000 kHz.

q. Depress AUTO (SWEEP) pushbutton, depress VAR (SWEEP) pushbutton, depress ± 5 MHz (RANGE SELECT) pushbutton, set RATE selector and control to SLOW and counter-clockwise, and set digital frequency dials to 15,000 kHz. Turn AUTO RANGE (SWEEP) control fully clockwise.

r. Observe counter. Frequency should sweep over a range of approximately 10,000 to 20,000 kHz in slightly less than 2 minutes. Depressing the ONE SHOT pushbutton initially will reset the sweep to the start level. The RATE control can be advanced clockwise to speed up the sweep time, if desired, for either VAR or ONE SHOT.

NOTE

The following checks are optional to check out FAST sweep and LINE sweep sync. The tests require an am or fm communications receiver or frequency discriminator which is tuned to any frequency within the range of 400 kHz to 80 MHz.

s. Depress OFF (SWEEP) pushbutton and the 1000 microvolt (OUTPUT LEVEL) pushbutton. Connect the generator output to the receiver input.

t. Set up the receiver on any frequency, and set the RF-808 frequency so the carrier can be heard in the receiver (to one side of the center of the receiver passband for an am receiver to provide slope detection).

u. Depress AUTO (SWEEP) pushbutton, depress VAR (SWEEP) pushbutton, depress ± 5 kHz (RANGE SELECT) pushbutton, set RATE selector and control to FAST and counter-clockwise. Set AUTO RANGE (SWEEP) control to full clockwise. The frequency modulation (sweep) should be audible from the speaker to some extent, and the frequency should be adjustable with the RATE control.

v. Depress LINE (SWEEP) pushbutton. The line frequency (usually 60 Hz) should be audible. The modulation level (deviation or sweep width) should be adjustable with the AUTO RANGE control setting.

5.5.6 Modulation Checks.

NOTE

If a receiver was used for the previous test, leave it set up to listen to the modulated signals to be generated.

a. Depress OFF (SWEEP) pushbutton, AM (MODULATION) pushbutton, and 1000 Hz pushbutton.

b. Run the MOD LEVEL control through its range, and check the modulation meter to see that modulation can be varied from 0 to 95%.

c. Depress 400 Hz pushbutton, and repeat step b.

d. Depress FM pushbutton, and set FM DEVIATION KHZ selector to 5.

e. Run the MOD LEVEL control through its range, and check the modulation meter to see that deviation can be varied from zero to full scale.

f. Reset FM DEVIATION-KHZ selector to 15, and repeat step e.

g. Reset FM DEVIATION-KHZ selector to 75, and repeat step e.

h. Reset FM DEVIATION-KHZ selector to 375, and repeat step e.

i. Depress PULSE (MODULATION) pushbutton. The rf output level, as noted on the output meter, should drop to zero with no input signal applied to the MOD IN/OUT jack.

NOTE

Receiver, if used, may now be disconnected.

5.5.7 Output Attenuator Checks.

a. Depress CW (MODULATION) pushbutton. Set digital frequency controls to 00,500 kHz.

b. Connect a calibrated 50 ohm, 1 watt dummy load, such as a Tektronix No. 011-0049-00 termination, and an rf voltmeter, such as a Hewlett-Packard No. 400F, to the output on the RF-808 Signal Generator.

CAUTION

When checking the +30 dBm output range of the generator, apply full signal level to the dummy load only briefly to avoid overheating the load. Momentarily, 2 watts will be applied to the 1 watt load.

c. Turn VARIABLE (OUTPUT LEVEL) control to maximum counterclockwise. Depress +30 DBM pushbutton, and set +30 DBM switch to ON.

d. With meter set up to check for 10 volt signal, turn up VARIABLE (OUTPUT LEVEL) control momentarily to check for 10 volt output from generator. Then, immediately set +30 DBM switch to OFF, and depress +20 DBM pushbutton. Level on the RF-808 and test meters should agree within $\pm$ 1 dB.

e. Set VARIABLE control for 3 volts on test meter. Levels on test meter and generator output meter should agree within $\pm$ 1 dB.

f. Continue checking lower output ranges in descending order until the lower level limitations of the test setup have been reached. Levels should agree within $\pm$ 1 dB at reach range.

NOTE

Since attenuator sections are reused on various ranges in different combinations, it is not necessary, within the scope of this procedure, to check the lower ranges, below the −60 dBm range.

5.6 TROUBLESHOOTING PROCEDURES.

5.6.1 General.

The first step in servicing a malfunctioning RF-808 is to sectionalize the fault to a defective module or assembly. The second step is to localize the fault to a defective part within the defective module or assembly. Some faults, such as burned-out resistors, arcing and shorted transformers and damaged wiring or connectors can often be located by sight, smell, or sound. The majority of faults, however, must be isolated by systematic troubleshooting procedures.

Listed below is a group of checks that will aid in tracing trouble to a defective module or assembly in the RF-808.

After the trouble has been localized, refer to the appropriate schematic diagrams and paragraphs referencing circuit descriptions and test data to isolate the defective component.

5.6.2 Troubleshooting Tables.

NOTE

Test equipment referenced in the following tables is listed in paragraph 5.5.2.

TABLE 5-1. RF-808 GENERAL TROUBLESHOOTING PROCEDURES.

Energize RF-808 and set front panel controls for the following conditions:
Frequency – 50 to 79,999 kHz
Modulation – CW
Sweep – OFF
Output Level – Any
Variable Level – Any

TROUBLE SYMPTOM	PROBABLE TROUBLE	CHECKS AND CORRECTIVE MEASURES
1. Ready Lamp out, no RF output	Power supplies main frame Regulator Board, A13 Pulse Mode selected in error A18 AM Output Loops A19 Output Amplifier	Refer to para 5.4.10 Refer to para 6.15 Refer to para 6.20 Refer to para 6.21 See condition 11
2. With counter on RF output connector, frequency does not change in approximately 10 MHz steps when 10 MHz frequency control is rotated, with ready light on.	A14 VHF Loop A A15 VHF Loop B	Refer to para 6.16 Refer to para 6.17
3. Lamp not illuminated when CAL button is depressed.	Lamp defective, Lamp driver, +3.6V Power Supply	Refer to para 5.4.9 & 5.4.10
4. Ready lamp not illuminated, output present	Lamp defective Rear panel FREQ. STD switch set to EXT.	Check with frequency counter for 1,000,000 MHz from rear panel FREQ. STD connector with switch set to INT.
5. With frequencies from 20.000 to 29.000 MHz selected in 1 MHz steps, output frequency does not change in approx 1 MHz steps.	A8 20–30 MHz OSC. A9 Sweep/Sample and Hold A20 Standard Divider A21 Frequency Standard Module	Refer to para 6.10 Refer to para 6.11 Refer to para 6.22 Refer to para 6.23
6. With frequencies selected from 20.000 to 20.900 MHz in 100 kHz steps and from 20.000 to 20.090 MHz in 10 kHz steps, locking occurs at some but not all frequencies.	A6 Low Speed Divider	Refer to para 6.9
7. With frequencies selected from 20.000 to 20.009 MHz in 1 kHz steps, and locking fails in these frequencies only.	A7 High Speed Divider	Refer to para 6.9

TABLE 5-1. RF-808 GENERAL TROUBLESHOOTING PROCEDURES (Cont).

TROUBLE SYMPTOM	PROBABLE TROUBLE	CHECKS AND CORRECTIVE MEASURES
8. Locking occurs in the range of output frequencies 0–20.5 MHz approx. but not 20.5–20.9 MHz approx. or vice versa.	A9 Sweep Sample/Hold	Refer to para 6.11
9. READY lamp brightness fluctuates.	A9 Sweep Sample/Hold A8 20–30 MHz Oscillator A7 High Speed Divider A6 Low Speed Divider	Refer to para 6.11 Refer to para 6.10 Refer to para 6.9 Refer to para 6.9
10. One or more of steps 5 through 8 indicates locking action occurs but READY lamp is not illuminated	Lamp defective Lamp circuitry on A12	Refer to para 6.14
11. RF Voltmeter connected to RF OUTPUT indicates signal present but OUTPUT LEVEL meter shows no reading.	OUTPUT LEVEL meter faulty or wiring open circuit A19 Output Amplifier	Refer to para 6.21
12. With RF Voltmeter connected to RF OUTPUT connector, reading changes with frequency, but OUTPUT LEVEL meter gives constant reading.	A12 Attenuator Assy	Refer to para 6.14
13. OUTPUT LEVEL meter reading varies with frequency	A18 AM Output Loop A19 Output Amplifier	Refer to para 6.20 Refer to para 6.21
14. Locking is lost when VERN SWEEP mode is selected.	A11 20 MHz Sweep	Refer to para 6.13
15. When in VERN and at 000 Hz CAL control will not produce a zero beat.	A11 20 MHz Sweep	Refer to para 6.13 Connect counter & RF OUTPUT connector. If reading is not within 100 Hz of selected frequency XTAL OSC on A11 must be readjusted. (VERNIER OSC ADJ)
16. With frequency controls set to 00000, OUTPUT meter shows a reading when VARIABLE LEVEL Control is fully clockwise. This indicates an OUT OF LOCK condition.	A14 VHF Loop A A15 VHF Loop B A9 Sweep/Sample and Hold A10 20 MHz PLL	Refer to para 6.16 Refer to para 6.17 Refer to para 6.11 Refer to para 6.12

TABLE 5-2. CW MODE, FREQUENCY AND OUTPUT CHECKS

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 50 kHz to79,999 MHz
Modulation – CW
Sweep – OFF
Output Level – 0 dBm
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE	REFERENCE
1. No Output	A12 Attenuator Assembly A19 Output Amplifier A18 AM Output Loops A14 VHF Loop A A15 VHF Loop B A5 Mod/Sweep Board Power Supply	Para 6.14 Para 6.21 Para 6.20 Para 6.16 Para 6.17 Para 6.8
2. Low Output Level	A12 Attenuator Assembly A19 Output Amplifier A18 AM Output Loops A14 VHF Loop A A15 VHF Loop B A5 Mod/Sweep	Para 6.14 Para 6.21 Para 6.20 Para 6.16 Para 6.17 Para 6.8
3. Incorrect Frequency, Ready Light on	A14 VHF Loop A A15 VHF Loop B A10 20 MHz PLL A21 Frequency Standard	Para 6.16 Para 6.17 Para 6.12 Para 6.23
4. Incorrect Frequency, Ready Light Off	A6 Low Speed Divider A7 High Speed Divider A8 20–30 MHz OSC A9 Sample Hold Board A20 STD Divider A21 Frequency Standard	Para 6.9 Para 6.9 Para 6.10 Para 6.11 Para 6.22 Para 6.23
5. Incorrect Frequency in CW Mode, but correct in VERN or MAN SWEEP Modes.	A10 20 MHz PLL	Para 6.12

TABLE 5-3. AM MODE, MODULATION AND FREQUENCY CHECKS.

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 50 kHz to 79,999 MHz
Modulation – AM
Sweep – OFF
Output Level – 0 dBm
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE	REFERENCE
1. No Modulation	A5 MOD/SWEEP A18 AM Output Loops	Para 6.8 Para 6.20
2. Incorrect Modulation Level or Distorted modulation	A5 MOD/SWEEP A18 AM Output Loops A19 Output Amplifier	Para 6.8 Para 6.20 Para 6.21

TABLE 5-4. FM MODE, MODULATION AND FREQUENCY CHECKS

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 50 to 79,999 MHz
Modulation – FM
Sweep – OFF
Output Level – 0 dBm
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE	REFERENCE
1. No Modulation	A5 Modulator/Sweep A10 20 MHz PLL A11 20 MHz Sweep A16 Discriminator	Para 6.8 Para 6.12 Para 6.13 Para 6.18
2. Incorrect Output Frequency	A16 Discriminator A11 20 MHz Sweep	Para 6.18 Para 6.13

TABLE 5-5. PULSE MODULATION CHECK

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 50 to 79,999 kHz
Modulation – Pulse
Sweep – OFF
Output Level – 0 dBm
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE	REFERENCE
1. Pulse Modulation Inoperative	A19 Output Amp. A18 AM/Output Loops	Para 6.21 Para 6.20

TABLE 5-6. CW MODE, ZERO BEAT AND FREQUENCY CHECKS.

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 50 kHz to 79, 999 kHz
Modulation – CW
Sweep – Vernier
Output Level – 0 dBm
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE	REFERENCE
1. Cannot Zero on center frequency	A11 20 MHz Sweep A3 Sweep Buffer A2 Vernier Assembly	Para 6.13 Para 6.6 Para 6.5
2. Zero Beat Signal Inoperative	A11 20 MHz Sweep A20 Standard Divider A10 20 MHz PLL	Para 6.13 Para 6.22 Para 6.12
3. Frequency incorrect by more than 200 Hz, but frequency is correct in CW Mode.	A11A2 20 MHz XTAL OSC	Para 6.13

TABLE 5-7. CW MODE, FREQUENCY CHECK

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 50 kHz to 79,999 kHz
Modulation – CW
Sweep – Manual
Output Level – 0 dBm
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE	REFERENCE
1. ± 500 Hz or ± 5 kHz Range Inoperative	A11 20 MHz Sweep (XTAL OSC) A10 20 MHz PLL A3 Sweep Buffer A16 Discriminator	Para 6.13 Para 6.12 Para 6.3 Para 6.18
2. ± 50 kHz or ± 500 kHz Range Inoperative	A11 20 MHz Sweep (LC OSC) A16 Discriminator A3 Sweep Buffer	Para 6.13 Para 6.18 Para 6.6
3. ± 5 MHz Range Inoperative	A16 Discriminator A14 VHF Loop A A17 Mixer Divider A3 Sweep Buffer	Para 6.18 Para 6.16 Para 6.19 Para 6.6
4. 0–80 MHz Range Inoperative,	A16 Discriminator A15 VHF Loop B A17 Mixer Divider A3 Sweep Buffer	Para 6.18 Para 6.17 Para 6.19 Para 6.6

TABLE 5-8. CW MODE, SWEEP CHECKS

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 50 to 79,999 kHz
Modulation – CW
Sweep – Auto, Var. or Trig.
Output Level – 0 dBm
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE	REFERENCE
1. No Sweep	A5 Mod/Sweep A3 Sweep Buffer	Para 6.8 Para 6.6
2. Certain Ranges Inoperative	See Manual Sweep Conditions	
3. One-Shot Inoperative	A5 Mod/Sweep	Para 6.8
4. Sweep Inoperative in Slow Range	A5 Mod/Sweep	Para 6.8
5. Line Sync Inoperative	Power Supply	Para 5.4.10
6. External Trigger Inoperative but LINE and VAR operative	J3 (Rear Panel) Wiring	Para 6.5
7. Blanking output Inoperative	J4 (Rear Panel) Wiring A5 Mod/Sweep	Para 6.5 Para 6.8
8. Pen Lift Inoperative	J5, J6 (Rear Panel) Wiring A5 Mod/Sweep	Para 6.5 Para 6.8
9. No Signal at Sweep out jack	J9 Wiring A5 Mod/Sweep	Para 6.5 Para 6.8

TABLE 5-9. REMOTE OPERATION CHECKS

Energize the RF-808 and set front panel controls for the following conditions:
Frequency – 00000 (Remote)
Modulation – Remote
Sweep – OFF
Output Level – Remote
Variable Level – Mid-Range

TROUBLE SYMPTOM	PROBABLE TROUBLE DEFECTIVE	REFERENCE
1. Frequency Programming Incorrect or Inoperative	J1 Wiring	Para 6.5
2. Modulation Programming Incorrect or Inoperative	J1 Wiring	Para 6.5
3. Output Level Programming Incorrect or Inoperative	J1 Wiring	Para 6.5
4. Variable Level Programming Inoperative	S48 Wrong position J1 Wiring	Para 6.5 Para 6.5
5. Remote Frequency Vernier Inoperative	J1 Wiring A3 Sweep Buffer	Para 6.5 Para 6.6

CHAPTER 6

MAINTENANCE

6.1 INTRODUCTION.

This chapter contains instructions and procedures for repairing, adjusting and aligning the RF-808 Signal Generator. Material in the form of detailed circuit descriptions, test data, and alignment and adjustment procedures for each assembly within the unit, as well as an over-all system alignment procedure is provided to enable service personnel to quickly isolate faulty components and to repair and maintain the unit.

6.2 PREVENTIVE MAINTENANCE.

Periodically, depending upon usage and invironmental conditions, the chassis should be cleaned by removing dust with a soft bristle brush. Dirt can be removed by using a damp cloth and mild detergent. The mechanical assemblies, gear trains and other moving parts are either made of nylon or are self lubricating and do not require periodic lubrication.

6.3 TEST EQUIPMENT.

NOTE

The following test equipment or equivalent is required to perform test and alignment procedures detailed in this chapter.

Digital Voltmeter	–	Fluke, DVM, Model 8100
Oscilloscope	–	Tektronix, Model 543 with Model 1A1 Plug-in unit.
Frequency counter (80 MHz with 1 Hz resolution and esternal frequency standard input)	–	Eldorado, Model 1650
Spectrum Analyzer	–	Hewlett-Packard Spectrum Analyzer, Model 8554L/8552A and 141S display.
Multimeter	–	Simpson, Model 260
Regulated Power Supply	–	Sorensen QS 40-.5
20 ± .1 dB, 2 Watt Attenuator	–	
Audio Oscillator	–	Hewlett-Packard, Model 200 AB
AM/FM Communications Receiver	–	
RF Voltmeter with 50 ohm probe	–	Boonton Model 91H
Extender Cable	–	RF P/N 808-0356
Extender Board	–	RF P/N 808-0170
Extender Board	–	RF P/N 808-0370 (for A20 Board Only)
Extractor Tool	–	RF P/N MP480000
Alignment Tool	–	RF P/N MP480001

6.4 PRINTED CIRCUIT BOARD REPAIRS.

6.4.1 Replacing Components.

The following general rules should be observed when replacing components on printed circuit boards.

a. When replacing components on printed circuit boards, clip the mounting leads first with a suitable pair of diagonal cutters and remove the component. This is especially helpful on multilead components such as the dual in-line and circular type integrated circuits. The individual leads are then removed from the PC board with a low wattage iron.

b. Before removing an integrated circuit or transistor from a PC board, note orientation of the pin locating tab and install the replacement component in exactly the same way. (See paragraph 6.4.2).

c. Because of the double sided construction used on many of the PC boards in the RF-808, a component lead may be soldered to printed circuit areas on the top as well as the bottom of the PC board. Consequently, when a component lead is removed, resolder the replacement component top and bottom where applicable.

d. Overheating a printed circuit conductor may cause it to pull loose from the board material. Apply only the minimum amount of heat necessary for component removal or replacement. The use of a soldering iron in the 25–35 watt range is recommended.

e. A desoldering tool (solder-sucker) similar to the UNILINE Mark VII, 40 watt type and the No. 7342 UNILINE tip is a great convenience (it also minimizes board damage) when removing multilead components which cannot be cut loose with diagonal cutters. The UNILINE Mark VII is available from: Vanguard Electronic Tools Inc., P.O. Box 543 Newton, Kansas 67114.

f. Another convenient device to use in place of a solder-sucker is a roll of Solder-Wick, manufactured by Solder Removal Co of Covina, California. Many of our personnel prefer this flux-saturated copper braid over a solder-sucker for removing solder from PC boards.

g. The RF-808 uses metal oxide field effect transistors (MOS-FETS) in some circuit applications. MOS-FETS require special care during handling to prevent burn-out of their insulated gate by static charges. Use the following procedure when replacing a MOS-FET transistor. (Common junction FETS do not require this procedure.)

(1) Remove new MOS-FET from package. Notice that the 4 leads are connected together with a small ferrule of wire. This prevents static charge differences between the gate and substrate terminals.

(2) If the ferrule is present, wrap several turns of solder or small gauge wire around the leads and then remove the ferrule.

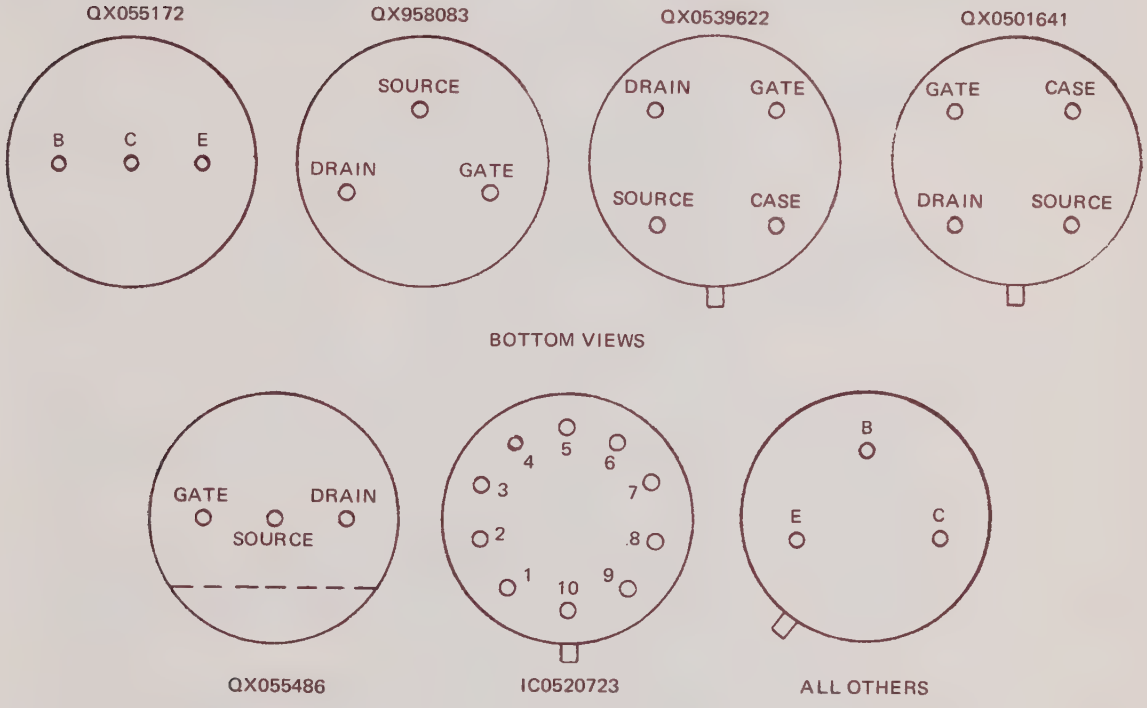
(3) Preposition the four leads and install the MOS-FETS on the PC board.

(4) Remove the jumper only after the leads are soldered.

6.4.2 Integrated Circuit and Transistor Basing Diagrams.

The pin orientation of integrated circuits and transistors used in the RF-808 are shown below.

TRANSISTOR AND IC CONNECTIONS



14 LEAD DUAL-IN-LINE
PLASTIC PACKAGE

16 LEAD DUAL-IN-LINE
PLASTIC PACKAGE

6.5 FRONT PANEL AND MAIN FRAME.

Mounted on the front panel (see figure 6-1) are the controls and indicators used for normal operation of the instrument. Mounted on the rear panel are input and output connectors and controls for special applications and remote operation. The chassis portion of the main frame contains the power transformers, low-voltage rectifiers, filter capacitors and Power Supply Regulator PC Board Assembly A13. In addition to controls and indicators, Sweep Buffer PC Board Assembly A3 and Attenuator Assembly A4 are mounted on the rear of the front panel. Procedures for gaining access to, and removing and replacing front panel and main chassis components are given below.

6.5.1 Front Panel Components.

NOTE

Tag and unsolder wires connected to hard-wire components or assemblies prior to their removal from the front panel.

a. Removal
   (1) Remove main frame top and bottom covers (Paragraph 5.3.2).
   (2) Rest RF-808 on its front panel handles, and remove screws (two on each side) securing the side panels to the rear panel. Slide the side panels up and out of the main frame panel guides.
   (3) Place the RF-808 in its normal position and remove the four screws securing the front panel handles and front panel to the main frame.
   (4) Pull the front panel forward to clear the RF OUTPUT connector. The front panel can now be tilted down to allow access to all components and assemblies mounted on the rear of the front panel.
   (5) Remove components and/or assemblies by removing the mounting hardware.

b. Replacement
   Replace components and assemblies by reversing the above removal procedures.

6.5.2 Main Frame Components.

Access to all main frame components and assemblies can be obtained by removing the top and bottom covers (paragraph 5.3.2). Prior to removing hardwired components and/or assemblies tag and unsolder connecting wires. Replacement procedures are the reverse of removal procedures.

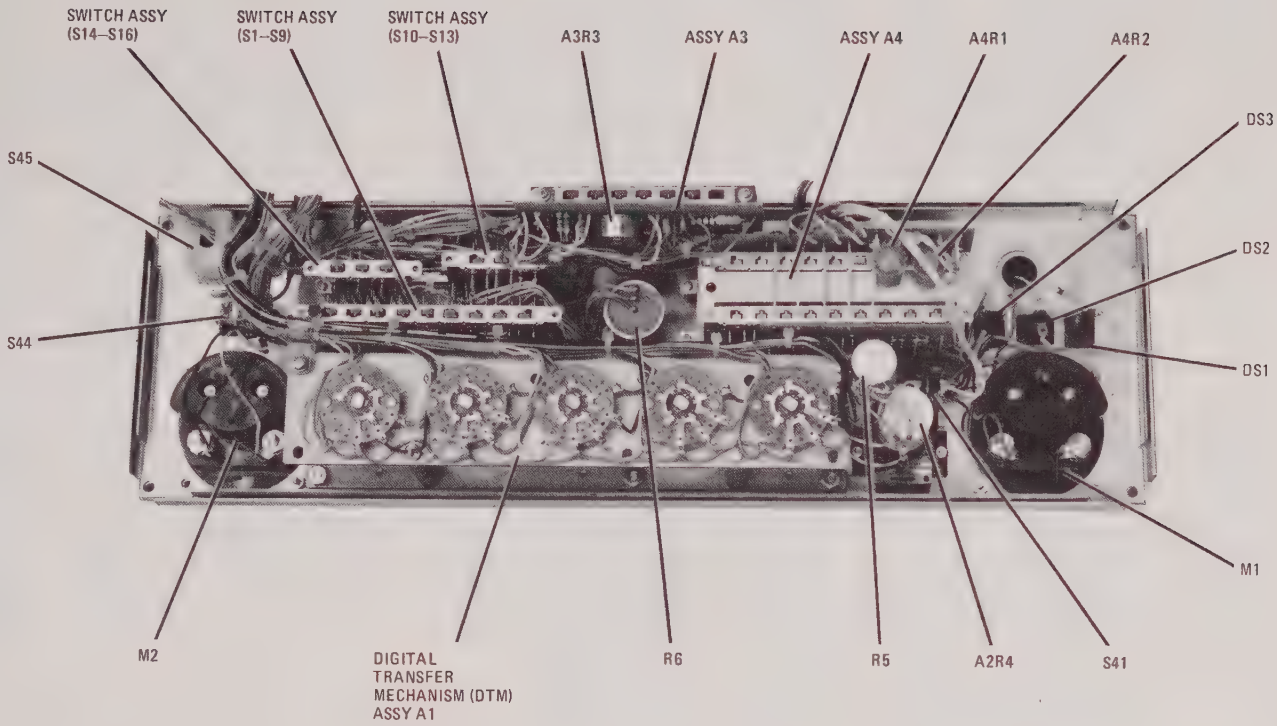


Figure 6-1. RF-808 Front Panel, Rear View.

6.6 SWEEP BUFFER PC BOARD A3.

6.6.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Sweep Buffer reference designators A3, unless otherwise specified.

Refer to schematic diagram, figure 6-3. Sweep Buffer PC Board A3 contains an operational amplifier (IC1) used to amplify the signal from either the AUTO/MANUAL SWEEP control or the VERNIER control, the operational amplifier output is buffered by emitter follower Q1 to provide a lower output impedance in order to drive the control lines on 20 MHz Sweep PC Board A11 and Discriminator PC Board A16. The SWEEP signal is applied to the noninverting input of IC1 at E2. The gain is determined by R5 and the total resistance from pin 4 of IC1 to ground. The latter is made up of R1on A3, R19 on the RANGE SELECT switch assembly, and R26 on the AUTO switch. These are switched in as needed to control the gain according to the SWEEP RANGE selected. C1, C2, C3 and R4 shape the frequency response of the amplifier.

R3 is used to set the voltage across the VERNIER potentiometer on Vernier Assembly A2, so that when in the VERNIER MODE with the VERNIER dial set at 999 Hz, the output frequency of the generator is 999 Hz higher than that indicated by the DTM (A1) dials.

Q2 and Q3 are used to provide control when operating VERNIER in the REMOTE mode. The REMOTE VERNIER control line from J1-15 is connected to the base of Q2 which is normally low, causing Q3 to be turned off. When J1-15 goes high, Q2 emitter goes positive and turns on Q3. The collector of Q3 is pulled down to −5 volts dc which turns on the 20 MHz VCXO on A11. The junction of R10 and R11 goes high and this point is connected to the 20 MHz ØLL Board A10, where it disables the 20 MHz phase-locked signal to the 300 MHz phase locked loop.

In this way the 20 MHz VCXO signal is substituted for the 20 MHz phase-locked signal in the 300 MHz PLL, a requirement for VERNIER operation.

6.6.2 Adjustment Procedures.

a. Remove main frame top cover (paragraph 5.3.2) and perform the initial turn on procedures in paragraph 3.3.

b. Set the RF-808 for an output frequency of 5,000 kHz CW.

c. Connect a digital voltmeter (DVM) to vernier potentiometer A3R3, pin 3 (figures 6-1, 6-2). Adjust A3R3 for a 1.200 ± .01 volts DVM indication.

d. Set the VERNIER DIAL to 000. Connect the DVM to pin 1 of the vernier potentiometer. Adjust the CAL CONTROL to obtain a reading of .000 ± .0005 volts.

e. Adjust Trimmer capacitor A11C5 (figure 6-19) to obtain a frequency of 5,000.000 kHz ± 1 Hz.

f. Set the VERNIER dial to 999. Adjust A3R3 to obtain a frequency of 5,001.999 kHz ± 1 Hz.

6.6.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

Remove the RF-808 front panel (paragraph to gain access to Sweep Buffer assembly A3 test points. Set the RF-808 controls for ± 5 MHz, MANUAL SWEEP with AUTO/MANUAL control fully CCW. Refer to figure for test points and component locations and figure for the assembly schematic diagram.

TABLE 6-1. A3 TRANSISTOR VOLTAGE CHART

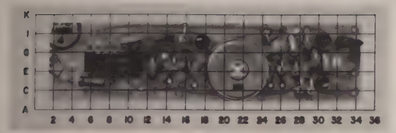
REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	−0.6	−1.2	−12.0	± 5 MHz, MANUAL SWEEP, AUTO/MANUAL control fully CCW
Q2	−0.9	−0.3	+9.6	
Q3	−5.8	−5.8	+0.7	

TABLE 6-2 A3 INTEGRATED CIRCUIT DC VOLTAGE CHART
(Voltages are nominal unless otherwise specified)

REF DESIG	PIN													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC1	–	–	–	−0.6	−0.6	−12.0	−12.0	–	–	−1.2	+12.0	–	–	–

TABLE 6-3. A3 CONNECTOR PIN VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
E1	−0.6	± 5 MHz, MANUAL SWEEP, AUTO/MANUAL control fully CCW.
E2	−0.6	
E3	−0.6	
E4	−12.0	
E5	+12.0	
E6	+1.2	
E7	−5.2	
E8	−0.3	
E9	−10.7	
E10	+10.7	
E11	−0.3	
E12	−0.3	



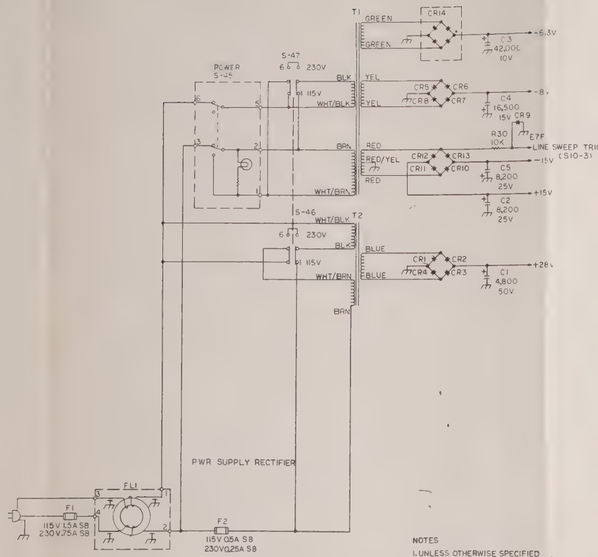
A3

REF DESIG	LOCATION
C1	E,13
C2	H,10
C3	I,14
C4	H,29
C5	F,30
C6	F,31
C7	H,26
CR1	E,15
CR2	E,28
IC1	F,8
Q1	H,18
Q2	H,31
Q3	D,31
R1	D,6
R2	I,24
R3	E,22
R4	G,14
R5	G,16
R6	I,28
R7	C,28
R8	H,34
R9	C,29
R10	G,27
R11	E,26
R12	I,16

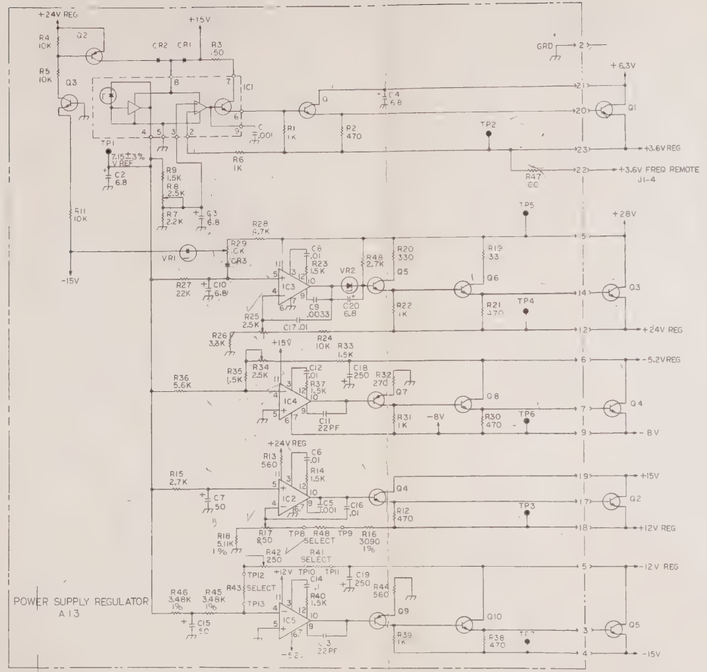
Wire Connections

E1	D,2
E2	C,11
E3	D,14
E4	C,16
E5	I,6
E6	D,17
E7	E,34
E8	I,34
E9	C,32
E10	C,34
E11	C,25
E12	C,26
E13	G,34

Figure 6-2. Parts Location, Assembly A3 (REV E)



NOTES
1. UNLESS OTHERWISE SPECIFIED
   A. ALL RESISTANCE IS IN OHMS, 1/4W
   B. ALL CAPACITANCE IS IN MICROFARADS



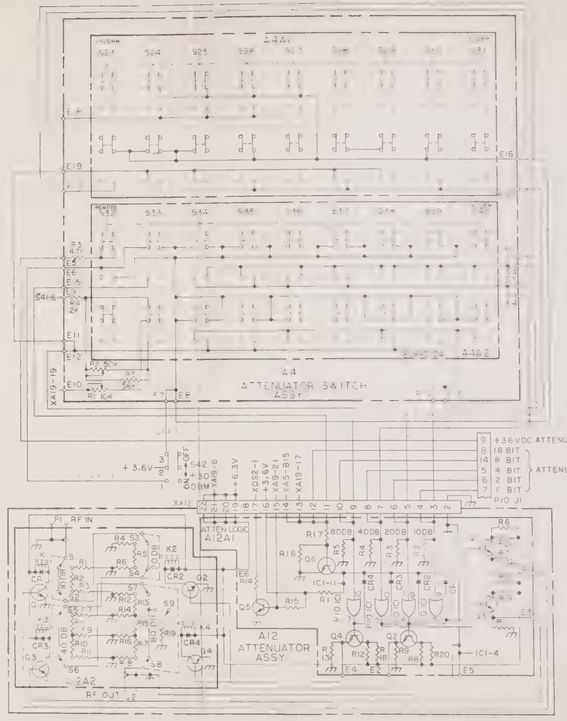


Figure 6-3. RF-808 Main Frame. Schematic Diagram (1 of 2)

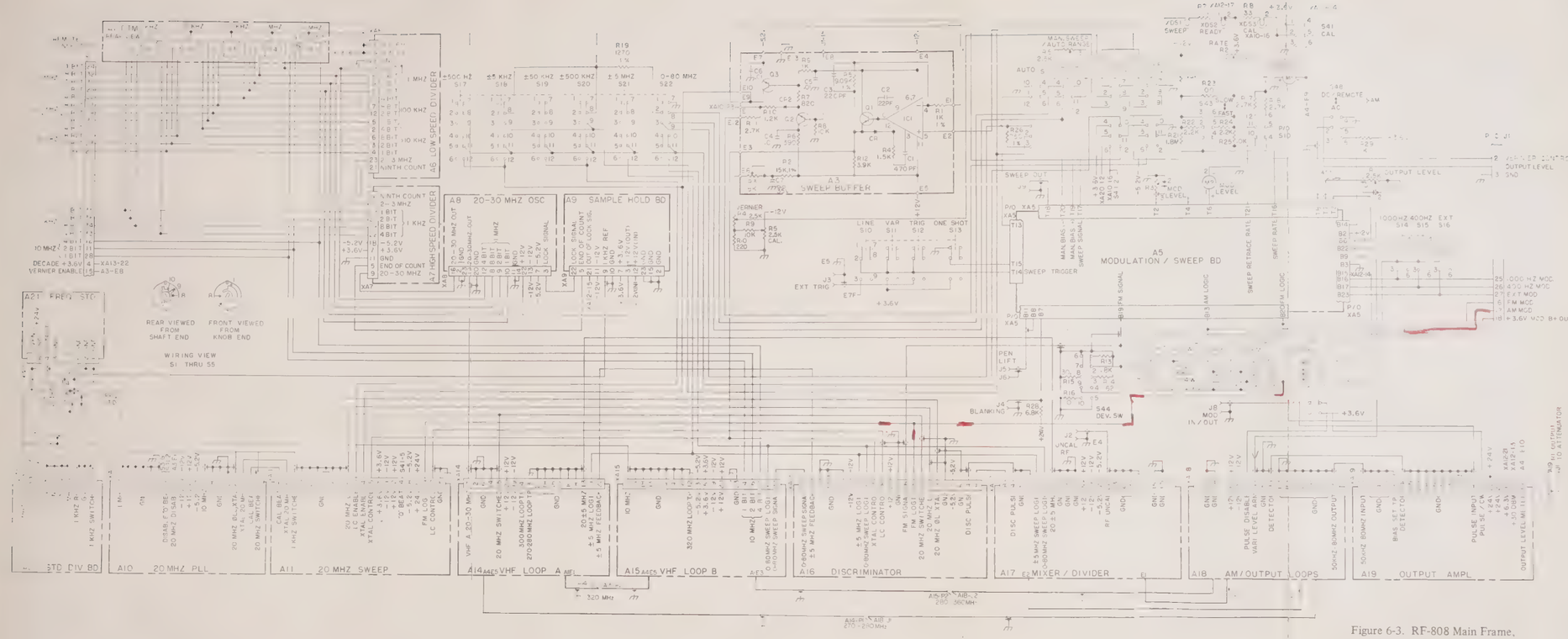

A6 LOW SPEED DIVIDER
A8 20-30 MHZ OSC
A9 SAMPLE HOLD BD
A3 SWEEP BUFFER
A5 MODULATION / SWEEP BD
A21 FREQ STD
STD DIV BD
A10 20 MHZ PLL
A11 20 MHZ SWEEP
A14 A4E5 VHF LOOP A
A15 A4E5 VHF LOOP B
A16 DISCRIMINATOR
A17 E5 MIXER / DIVIDER
A18 AM/OUTPUT LOOPS
A19 OUTPUT AMPL
REAR VIEWED FROM SHAFT END
FRONT VIEWED FROM KNOB END
WIRING VIEW S1 THRU S5

Figure 6-3. RF-808 Main Frame, Schematic Diagram (2 of 2)

6.7 ATTENUATOR SWITCH ASSEMBLY A4.

6.7.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Attenuator Switch Assembly reference designator A4, unless otherwise specified.

Refer to schematic diagram figure 6-3. The ATTENUATOR SWITCH pushbuttons control the relays which insert attenuator pads into the coaxial line from the output amplifier to the RF OUTPUT connector. The relays, associated drives and pads are located on ATTENUATOR Assembly A12. When the REMOTE button is depressed, +3.6V is made available at J1-9 through resistor R3 for use in remote programming of the attenuator. R1 and R4 are scaling resistors for the OUTPUT VOLTS METER for all ranges up to +20 dBm. When the +30 DBM button is depressed, additional scaling resistors R2 and R5 are connected to maintain the same full-scale reading as the detector output signal from XA19-19 increases.

6.7.2 Adjustment Procedures.

a. Remove main frame top cover (paragraph 5.3.2) and perform the initial turn-on procedures in paragraph 3.3.

b. Set the RF-808 for an output frequency of 5,000 kHz CW.

c. Depress the +20 DBM switch.

d. Turn the VARIABLE LEVEL control CCW.

e. Connect the 91H RF Voltmeter with the 50 ohm probe to the RF OUTPUT connector. Set the 91H to the 3.0V range.

f. Turn the VARIABLE LEVEL control to approximately 90% of its range.

g. Adjust A5R77 (figure 6-4) to obtain a reading of 3.0V rms on the 91H. Turn the VARIABLE LEVEL control fully CW and note that an output of greater than 3.16V rms is obtained.

h. Set the VARIABLE LEVEL control to obtain a reading of 2.0V rms on the 91H. Adjust R1 behind the front panel to obtain a front panel meter reading of 2.0V rms.

i. Set the VARIABLE LEVEL to 3.0V rms.

j. Connect the 91H with the 50 ohm probe through a 2W 20 dB pad to the RF OUTPUT connector. Set the 91H to the 1.0V range.

k. Set the +30 DBM switch to ON and depress the +30 DBM button.

l. Adjust A5R75 for an output of 1.0V rms on the 91H RFVM.

m. Adjust R2 behind the front panel to obtain a front panel reading of 1.0V rms.

6.8 MODULATION/SWEEP PC BOARD A5.

6.8.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Modulation/ PC Board reference designator A5.

The Modulation/Sweep board (A5) contains the 400 Hz and 1 kHz oscillators used in the AM and FM modulation modes, the sweep generator, logic circuitry to direct the modulating signal into either the AM or FM path and a current source used to set the maximum output level of the generator.

Refer to schematic diagram figure 6-5. The same oscillator circuit is used for both 400 Hz and 1 kHz frequencies. Components are switched in the frequency determining network to select the frequency of oscillation. Transistors Q1, Q2 and Q3 are the active components of the Wien Bridge oscillator. Resistors R4, R7 and R8 form a DC feedback path and provide biasing for the amplifier. The output of the oscillator at the collector of Q1 is AC-coupled through C2 to the potential divider R5, R6 and DS1. The signal developed across DS1 is applied via C4 as negative feedback to the emitter of Q3. The impedance of DS1 increases as the power dissipated in it increases, and hence so does the feedback. In this way the oscillator amplitude is stabilized.

The oscillator frequency is determined by C5, R89, R11, R10, R90, R9 and R91, and by C7, R13, R93 and R15 when in the 1 kHz mode or by C6, R12, R92 and R14 when in the 400 Hz mode. To select the 400 Hz mode, pin B17 is high. This makes pin 2 of IC3 go low, which turns on Q7 which then effectively grounds the gate of Q5, turning it on. This provides a ground return for those components which determine the 400 Hz frequency of operation. At the same time CR1 conducts and Q9, Q10, Q4 and Q24 turn on. Q4 provides a return to −12 VDC for the oscillator circuit thus starting oscillations. Q24 turns on relay K2 which provides a path for the oscillator output to pin T2 which goes to one end of the potentiometer controlling the modulation level. When pin B17 goes high a similar sequence of events takes place but the oscillator operates at 1 kHz. R64 feeds the oscillator output through terminal T3 to the MOD IN/OUT connector. In the EXT. MODULATION mode pins B16 and B17 are low, disabling the internal oscillator. Pin B23 is high, turning on Q25, which energizes relay K3; this connects the external modulation signal input on pin T3 directly to T2 by bypassing R64.

When in the AM MODULATION mode, B13 is high, which makes pin 12 of IC4B low. Provided the +30 DBM OUTPUT LEVEL switch is in the OFF position, and the +30 DBM OUTPUT LEVEL switch A4S33 is not depressed, pin 13 of IC4 is also low. Pin 14 of IC4 is then high and holds Q26 on. This operates relay K4 which connects the output of the MOD LEVEL control via C15, to the VARIABLE OUTPUT LEVEL control potentiometer. The AC output of the MOD LEVEL control is connected to emitter follower Q28. C13 and CR14 act as a DC clamp circuit and the waveform appearing on CR14 is a replica of the modulating waveform with the negative peaks clamped to approximately zero volts. The modulation meter thus responds to the average value of the modulation waveform for modulating frequencies greater than 20 Hz. It is important to remember this fact if it is desired to make use of the modulation meter when complex external modulation inputs are used. R73 is a calibration adjustment for the modulation meter.

In the FM MODULATION mode, B20 is high, which turns on Q27. This operates relay K5 which connects the output of the MOD LEVEL control to the FM SIGNAL line on B19 through series resistors R95 and R107. The FM SIGNAL line is shunted to ground through one of four resistors as determined by the position of the front panel FM DEVIATION switch. These resistors and R95 and R107 control the maximum level of the FM SIGNAL reaching the discriminator board (A16) and hence the maximum deviation for any deviation range.

The maximum output level of the generator, at any attenuator setting, is determined by the voltage on one end of the VARIABLE OUTPUT LEVEL control. This voltage is fixed by controlling the current from the collector of Q31, connected as a current source. In the AC position of the AM, AC-DC/REMOTE switch S48 B14 is high, which turns on Q30. The voltage divider R76 and R77 fixes the voltage at the base of Q31 and hence at the emitter. The voltage across R78 then controls the current through Q31. If, in addition, the +30 DBM switch is ON, B15 is high, which means that pins 1 and 2 of IC4 are both low. Pin 3 of IC4 is then high, and Q29 is on. This connects R75 in parallel with R77 and increases the voltage across R78 and hence across the VARIABLE OUTPUT LEVEL control thus increasing the RF output voltage. When the AM switch is set to DC/REMOTE, B14 is low and Q30 is off, Pin 6 of IC3 is high, making pin 3 low and holding Q29 off, also. Thus no voltage is developed across R76 and so Q31 is off. The voltage across the VARIABLE OUTPUT LEVEL control is then zero. In this mode the high end of the VARIABLE OUTPUT LEVEL potentiometer is connected via the AM, AC-DC/REMOTE switch to a pin of the rear panel REMOTE connector. Varying the voltage applied to this pin controls the output level of the generator.

When the SWEEP control is set for MANUAL mode operation, the manual sweep control line voltage is taken from the wiper of the AUTO/MANUAL SWEEP potentiometer, the ends of which are set to +0.6 and −0.6 volts. Therefore by rotating the MANUAL SWEEP control, the voltage on the control line can be varied over the range ± 0.6 volts. These end point voltages are developed on A5 as follows. Resistors R101, R78 and R97 form a voltage divider across the +12V supply. The voltage at the wiper of R78 is buffered by complementary emitter followers (used to cancel the variation in base-emitter voltage with temperature) Q35 and Q36 and appears relatively unchanged in level at pin T19. R78 is used to set the level to precisely +0.6 volts. In a similar way, R88 is used to set the voltage at T20 to −0.6 volts. T19 and T20 are connected to the ends of the AUTO/MANUAL SWEEP potentiometer.

When the SWEEP control is set for AUTOMATIC mode, the sweep voltage may be initiated in one of several ways. It may be allowed to run repetitively at a rate determined by the front panel RATE and FAST-SLOW switch positions. When the TRIG button is depressed the sweep can be triggered repetitively at a rate determined by a signal applied externally through the SWEEP TRIGGER connector J3 on the rear panel. If synchronized operation at line frequency is desired, the LINE button must be depressed. The trigger for this mode is derived internally from the power transformer. Also, a single sweep can be generated each time the ONE SHOT button is depressed.

In AUTOMATIC operation, with the SWEEP, AUTO and VAR buttons depressed, pin T13 is open circuited and pin T14 is high. These facts should be noted in the following description of circuit operation.

The heart of the sweep circuit is the operational amplifier IC1 connected as an integrator. The input impedance is increased by Q13 operating as a source follower, and the output impedance is decreased by Q14 operating as an emitter follower. Capacitor C8 connected from input

to output is the integrating capacitor. The amount of current flowing out of pin T16 is determined by the SWEEP FAST-SLOW switch and RATE control, and is increased as the SWEEP RATE control is advanced. The gate of Q13 is a very high impedance and since the voltage gain of IC1 is very high, the current flowing out of pin T16 all flows through C8 and the voltage at Q13 gate remains constant. Thus as C8 charges, the potential at the emitter of Q14 increases at a linear rate. This voltage ramp is attenuated by R59, R96 and R97, buffered by compound emitter followers Q38 and Q40, and appears as an output on pin T17, and then it is connected to the SWEEP AUTO/MANUAL potentiometer. The sweep voltage is also connected through R86 to the SWEEP OUT connector on the front panel. R40 is used to compensate for the variations in the voltage offset of IC1 and the gate/source voltage of Q13. R39 determines the current flowing in Q13 and is chosen to ensure that Q13 operates close to the point where the drift with temperature of the gate/source voltage is a minimum. The correct setting of R40 then ensures that the gate of Q13 operates close to ground, and thus can be considered as a SWEEP CENTER adjustment, so that the sweep operates linearly between −5.0 and +5.0 volts.

The sweep ramp voltage is also connected to the base of Q19 which turns on at approximately +5 volts as set by the POSITIVE SWEEP LIMIT potentiometer R55. At the positive sweep limit, Q19 then turns on Q20 which, through R47 and CR8, causes pin 2 of IC2 to go high. Pins 3 (IC2) and 12 (IC2) then go low, pin 14 goes high and pin 3 is latched low, which turns off Q23 de-energizing relay K1 and generating the penlift signal. Q22 is also turned off, which allows its collector on pin B7, connected to +24V through R28 on the front panel, to go positive to provide a BLANKING signal. Q21 also turns off, and switches Q12 off, allowing the base of Q11 to fall to a potential established by R35, R36 and the voltage on T21, the SWEEP RETRACE RATE line. In the SLOW position of the FAST-SLOW RATE switch, this potential is high enough to hold off Q34. The current flowing through the collector of Q11 is then determined by the value of R32. This current flows into the summing junction at the gate of Q13, a virtual ground. A portion of this current flows out of T16, the rest flows through C8. Thus the emitter of Q14 starts to fall at a linear rate, designed to be approximately 10 times faster than the positive sweep ramp. When the Q14 emitter reaches -5 volts, as set by the NEGATIVE SWEEP LIMIT resistor R45, Q15 turns on. This, in turn, causes Q16, Q17 and Q18 to turn on. When Q17 turns on, its collector voltage falls and is held at ground by CR5. Pins 2 and 9 of IC2 are then low. Since pin 10 is also low, by virtue of the high on pin 6, pins 8 and 13 go high. Pins 14 and 1 then go low, and because pin 2 is low, pin 3 goes high and latches there. This action returns the circuit to the condition necessary for the start of the sweep. Q23 turns on energizing K1 the PEN LIFT relay, Q22 turns on returning the BLANKING line to ground and Q21 turns on. The latter turns on Q12 which clamps the base of Q11 to +12V, turning it off. The linear SWEEP now begins again. When Q21 turns on, the anode of CR7 is held close to ground and Q15 turns off, allowing the positive-going ramp to begin, without first having to remove the current flowing in the base of Q15.

The sequence for the FAST SWEEP RATE is the same as that described for SLOW SWEEP except that the currents flowing out of pins T16 and T21 are greater. The latter decreases the positive potential at the base of Q11 which then turns on Q34. The current flowing out of the collector of Q11 is now increased and the SWEEP RETRACE is consequently faster. At high sweep speeds, the potential on T21, the SWEEP RETRACE line is low enough to turn on Q32, which then turns on Q33. Q23 is then held off and the PEN LIFT RELAY K1 remains de-energized. C16 charges to the peak negative excursion of the voltage at T21 so that Q23 does not switch at the sweep rate.

In TRIGGERED operation when the SWEEP, AUTO and TRIG buttons are depressed, the operation is similar to that for the VARIABLE mode except that the SWEEP ramp is initiated each time that the SWEEP TRIGGER on pin T14 goes high. At the end of the SWEEP RETRACE period pins 2 and 9 of IC2 are low. When a positive going SWEEP TRIGGER is received pin 8 goes high and sets the latch. Pin 3 goes high and starts the sweep. Until the trigger is received the sweep is held at its negative excursion as follows: When the sweep voltage reaches the negative limit Q15 turns on and this then turns on Q16, Q17 and Q18. The collector current for Q18 is derived from Q11. Thus if the integrator output attempts to go more negative, Q15 and hence Q18, turn on harder. This reduces the current flowing into the summing junction at Q13 gate, and if CR4 is cut off, current will be flowing out of T16, causing the integrator output to rise, thus opposing the original trend. Thus the circuit acts to maintain the current into the summing junction close to zero, and Q15 in a state of conduction. For proper operation, the sweep rate should be set faster than the trigger rate.

In AUTO LINE SWEEP Mode, with the LINE button depressed, the operation is similar to the triggered mode, with the sweep triggered at line frequency on T14 . The FAST/SLOW switch and RATE control are inoperative and are replaced by fixed resistors R17 and R18 located on the front panel.

ONE-SHOT operation is similar to the triggered mode, except that the trigger is applied through C12 to pin 7 of IC2, pin 6 being open circuited. Each time the ONE-SHOT button is depressed, pin T15 is switched from ground to +3.6 volts thus providing a trigger to initiate the sweep. If the ONE-SHOT button is depressed while the sweep output is rising, the trigger is applied via R58 to pin 2 of IC2, which was low. This resets the latch making pin 3 low, and the circuit begins to retrace.

When the AUTO button is not depressed pin T13 is grounded and the sweep circuit is held in the retraced condition.

6.8.2 Adjustment Procedure.

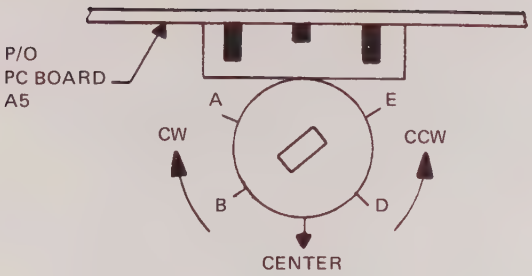
CAUTION

Ensure that RF-808 POWER ON/OFF Switch is in OFF position prior to removing or replacing modules and printed circuit board assemblies.

a. Remove main frame top cover (paragraph 5.3.2). Extend board A5 from main frame using Extender Cable 808-0356. Perform initial turn-on procedures (paragraph 3.3). Refer to figure 6-4 for component locations.

NOTE

If it is suspected that the preset control adjustments have been tampered with or misadjusted in anyway, start alignment and adjustment procedures with the preset adjustment controls initially set to the approximate positions indicated below.



TYPICAL CONTROL

INITIAL POSITION OF PRESETS (APPROXIMATE)

A5R69	– A (Extreme Clockwise)
A5R40	– CENTER
A5R30	– E (Extreme counterclockwise)
A5R32	– B
A5R13	– D
A5R10	– D
A5R6	– B
ALL OTHERS	– CENTER

b. Connect an oscilloscope, frequency counter and digital voltmeter to the MOD IN/OUT Connector.

c. With the AM and 400 Hz pushbuttons depressed adjust A5R12 and A5R91 for a frequency of 400 Hz and an amplitude of approximately 6.5V peak-peak. With the 1000 Hz pushbutton depressed adjust A5R13 and A5R10 for a frequency of 1000 Hz and an amplitude of approximately 6.5V peak-peak. The adjustments of A5R12, A5R91, A5R13 and A5R10 interact and they should be alternately adjusted so that their amplitudes are within 1% of each other, and their frequencies are within 2% of the desired value. R6 should then give a maximum output between 6.5 and 7.0 volts peak to peak.

d. Set the MOD LEVEL control to approximately 90% of maximum and with the FM pushbutton depressed, adjust A5R6 so that the FM DEVIATION meter reads full scale.

e. Short the gate of A5Q13 to ground. Measure the voltage at TP2 (pin 4 of IC1). Adjust A5R40 so that the voltage on A5TP3 (pin 5 of IC1) is equal to that on A5TP2. Remove the short.

f. Connect an oscilloscope to the SWEEP OUT connector. In the AUTO SWEEP mode set SWEEP RATE to FAST and RATE control fully clockwise. Set A5R30 for a retrace time of between 2 and 3 milliseconds.

g. Connect an oscilloscope to the SWEEP OUT connector. In the AUTO SWEEP mode, set SWEEP RATE to SLOW and RATE control fully counterclockwise. Set A5R32 for a retrace time of between 10 and 15 seconds.

h. Connect the oscilloscope to the SWEEP OUT connector and depress the ± 5 kHz and the AUTO buttons.

i. Adjust A5R45 and A5R55 to obtain a ± 5.0V sawtooth. Control A5R45 is used to adjust the lower limit of the sweep while A5R55 adjusts the upper limit. Set the sweep amplitude to within ± 0.2V. Disconnect oscilloscope from SWEEP OUT connector.

j. Connect the scope probe to the output of the Sweep Buffer at the top of A3R5. Set the MANUAL SWEEP control fully CW and adjust the Sweep Amplitude control A5R69 for a sweep voltage of 12V ± 0.2V. Readjust A5R55 for a sweep of +6V ± 0.1V. Set A5R45 for –6V

± 0.1V. In these adjustments it may be necessary to slightly adjust A5R69 to achieve the required sweep voltage (± 6V ± 0.1V).

k. Depress the MANUAL SWEEP button. Select the ± 5 kHz sweep range and set the MANUAL SWEEP control in the fully CCW position. Connect the DVM to the output of the sweep buffer (top of A3R5). Adjust variable resistor A5R88 for a sweep buffer output of −6.00 ± .02V.

l. Set the MANUAL SWEEP control to +5 kHz and adjust A3R87 for a sweep buffer output of +6.00 ± .02 volts.

m. Set the RF-808 output frequency to 5,000 MHz.

n. Depress the +20 DBM button.

o. Turn the VARIABLE LEVEL control CCW.

p. Connect the 91H RF Voltmeter with the 50 Ohm probe to the RF OUTPUT connector. Set the 91H to the 3.0V range.

q. Turn the VARIABLE LEVEL to approximately 90% of its range.

r. Adjust A5R77 to obtain a reading of 3.0V rms on the 91H. Turn the VARIABLE LEVEL control fully CW and note that an output of greater than 3.16V rms is obtained.

s. Set the VARIABLE LEVEL control to obtain a reading of 2.0V rms on the 91H. Adjust R1 behind the front panel to obtain a front panel meter reading of 2.0V rms.

t. Set the VARIABLE LEVEL to 3.0V rms.

u. Connect the 91H with the 50 ohm probe through a 2W 20 dB pad to the RF OUTPUT connector. Set the 91H to the 1.0V range.

v. Set the ± 30 DBM switch to ON and depress the +30 DBM button.

w. Adjust A5R75 for an output of 1.0V rms on the 91H RFVM.

x. Adjust R2 behind the front panel to obtain a front panel reading of 1.0V rms.

y. Depress the 0 DBM pushbutton.

z. Depress the AM modulation pushbutton.

aa. Depress the EXT Modulation pushbutton.

ab. Set the VARIABLE LEVEL control for an output of 200 mV rms.

ac. Set the MOD LEVEL control fully CCW.

ad. Connect an audio oscillator to the MOD IN/OUT connector and a frequency counter.

ae. Set the oscillator to 2 kHz and its output level to a minimum.

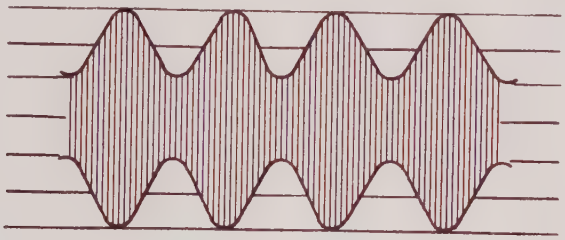
af. Set the MOD LEVEL control fully CW.

ag. Increase the external oscillator's level until a 100% reading is obtained on the MOD LEVEL METER.

ah. Set the MOD LEVEL control for a 90% reading on the MOD LEVEL METER and then adjust the oscillator level for a 100% reading.

ai. Connect a coax from the RF OUTPUT connector to the input of a scope. Terminate the scope input in 50 ohms.

aj. By means of simultaneously adjusting the 2 kHz external modulation level and the vertical gain of the scope, set the modulation as viewed on the scope for 50%.



ak. Adjust A5R73 for a 50% reading on the MOD LEVEL meter.

6.8.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend Modulation/Sweep PC Board A5 from the RF-808 main frame. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Where conditions are not specified, the RF-808 control settings and mode of operation will not affect the resultant data. Refer to figure 6-4 for test points and component locations and figure 6-5 for the assembly schematic diagram.

TABLE 6-4. A5 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC NOMINAL			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	+12.0	+12.0	+0.2	
Q2	+12.0	+12.0	+0.2	
Q3	+0.2	0	+12.0	
Q4	−12.0	−12.0		
Q5] FET	0 (Source)	−0.1 (Drain)	−12.0 (Gate)	
Q5] FET	0	−0.1	+0.7	400 Hz Modulation
Q6] FET	0 (Source)	−0.1 (Drain)	−12.0 (Gate)	
Q6] FET	0	−0.1	+0.7	1 kHz Modulation
Q7	+3.6	+3.6	−12.0	
Q7	+8.4	+0.16	+0.8	400 Hz Modulation
Q8	+3.6	+3.6	−12.0	
Q8	+8.4	+0.2	+0.8	1 kHz Modulation
Q9	+3.6	+3.6	−12.0	
Q9	+1.3	+0.7	−11.2	Internal Modulation
Q10	+3.6	+3.6	0	
Q10	+3.6	+2.9	+3.5	Internal Modulation
Q11	+8.9	+8.4	+0.3	
Q12	+12.0	+12.0	+8.4	
Q13 FET	+2.2 (Source)	+12.0 (Drain)	0 (Gate)	
Q14	−5.2	−5.8	−12.0	
Q15	−4.6	−5.2	−10.2	
Q16	−10.8	−10.2	0	
Q17	−11.4	−10.8	−0.6	
Q18	−12.0	−11.4	+0.3	
Q19	+0.6	−5.2	+12.0	
Q20	+12.0	+12.0	−0.6	
Q21	0	0	+12.0	
Q22	0	0	+24.0	
Q23	0	0	+7.3	
Q24	0	0	+7.3	
Q24	0	+0.7	+0.5	Internal Modulation
Q25	0	0	+7.3	
Q25	0	+0.7	+0.5	External Modulation

TABLE 6-4. A5 TRANSISTOR VOLTAGE CHART (Cont)

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q26	0	+0.2	+7.3	
Q26	0	+0.7	+0.8	AM mode, all but +30 dBm
Q27	0	+0.2	+8.5	
Q27	0	+7.6	+0.6	FM mode
Q28	−0.6	0	+6.6	
Q29	0	+0.2	+8.5	
Q29	0	+0.74	+0.03	+30 dBm
Q29	0	+0.13	+12.0	DC/Remote
Q30	0	+0.7	+0.04	
Q30	0	0	+12.0	DC/Remote
Q31	+9.2	+8.6	+3.0	
Q32	+6.0	+5.4	+5.3	
Q33	0	+0.6	+0.02	
Q34	+8.9	+9.6	+12.0	
Q35	+11.2	+0.6	−12.0	
Q36	+0.6	+1.2	+12.0	
Q37	−0.6	−1.2	−12.0	
Q38	−1.2	−0.7	+12.0	
Q39	−0.06	−0.7	−12.0	
Q40	−0.7	−0.06	+12.0	

TABLE 6-5. A5 INTEGRATED CIRCUIT DC VOLTAGE CHART
(Voltages are nominal unless otherwise specified)

REF DESIG	PIN													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC1	–	–	+8.0	+2.2	+2.2	−12.0	−12.0	−12.0	−11.3	−5.9	+12.0	+8.9	–	–
*IC2			GRD								+3.6			
*IC3			GRD								+3.6			
*IC4			GRD								+3.6			

* Voltages of logic levels are not shown.

TABLE 6-6. A5 TEST POINT AND CONNECTOR PINS VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
TP1	0	
TP2	+2.2	
TP3	+2.2	
TP4	−5.3	
TP5	+3.0	
TP6	0	
Connector Pins		
B2	12.0	
B3	0	
B4	-	
B5	–	
B6	7.4	
B7	24.0	
B8	0	
B9	+12.0	
B10	–	
B11	0	
B12	–	
B13	0	
B13	+3.6	AM mode
B14	+1.3	
B14	0	Dc/Remote
B15	0	
B15	+3.6	+30 dBm mode
B16	0	
B16	+3.6	1 kHz modulation
B17	0	
B17	+3.6	400 Hz modulation
B18	–	
B19	0	
B20	−4.9	
B20	+3.6	FM mode
B21	–	
B22	+3.6	
B23	0	
B23	+3.6	External modulation
T2	0	
T3	0	
T4	0	
T5	–	
T6	0	
T7	+3.0	
T8	+3.0	
T9	–	
T10	–	

TABLE 6-6 A5 TEST POINT AND CONNECTOR PINS VOLTAGE CHART (Cont)

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
T11	–	
T12	–	
T13	0	
T14	+3.6	
T15	0	
T15	+3.6	One-Shot button depressed
T16	−0.03	
T17	−0.65	
T18	-5.2	
T19	+0.6	
T20	−0.6	
T21	+4.8	
T22	–	

TABLE 6-7. A5 WAVEFORM DATA CHART

TEST POINT	WAVEFORM
Q1-C	7V P-P 400 Hz or kHz sine wave with RF-808 400 Hz or 1,000 Hz pushbutton depressed
Q2-C	2.0V P-P 400 Hz or 1 kHz sine wave with RF-808 400 Hz or 1,000 Hz pushbutton depressed.
Q3-B	2.0V P-P 400 Hz or 1 kHz sine wave with RF-808 400 Hz or 1,000 Hz pushbutton depressed.
Q3-E	2.0V P-P 400 Hz or 1 kHz sine wave with RF-808 400 Hz or 1,000 Hz pushbutton depressed.
TP4	fo MAX = 80 Hz FAST AUTO SWEEP RATE control fully CW.

PARTS LOCATION GUIDE FOR FIGURE 6-4, ASSEMBLY A5

A5

REF DESIG	LOCATION
C1	J,67
C2	W,69
C3	T,66
C4	U,69
C5	R,67
C6	L,64
C7	O,59
C8	AA,32
C9	Q,8
C10	K,9
C11	N,15
C12	V,29
C13	Z,49
C14	U,46
C15	X,39
C16	P,31
C17	H,65
C18	U,12
C19	U,7
CR1	U,55
CR2	X,55
CR3	G,33
CR4	U,28
CR5	Q,23
CR6	V,33
CR7	M,27
CR8	W,33
CR9	N.41
CR10	BB,63
CR12	AA,39
CR13	E,66
CR14	V,49
CR15	Z,71
DS1	I,72
IC1	O,10
IC2	S,32
IC3	H,44
IC4	O,46
K1	I,38
K2	CC,70
K3	CC,58
K4	CC,44
K5	F,58
Q1	P,64
Q2	P,66
Q3	P,68
Q4	M,54
Q5	K,55
Q6	J,59
Q7	Z,56
Q8	Z,53
Q9	Z,59
Q10	Z,62
Q11	J,29
Q12	J,23
Q13	T,22
Q14	R,14
Q15	L,15
Q16	O,19
Q17	Q,19
Q18	O,28
Q19	J,15
Q20	R,26
Q21	N,30
Q22	P,35
Q23	P,38
Q24	Z,67
Q25	Z,65
Q26	V,43
Q27	E,51
Q28	Y,51
Q29	T,48
Q30	T,42
Q31	X,43
Q32	L,33
Q33	P,37
Q34	J,21
Q35	Z,11
Q36	BB,11
Q37	BB,7
Q38	Y,7
Q39	Z,19
Q40	BB,19
R1	K,69
R2	K,68
R3	G,69
R4	U,65
R5	X,71
R6	W,72
R7	S,67
R8	U,60
R9	O,62
R10	S,61
R11	R,58
R12	I,63
R13	T,55
R14	O,61
R15	L,57
R16	L,56
R17	P,53
R18	Q,57
R19	Q,54
R20	P,55
R21	V,55
R22	W,55
R23	V,60
R24	W,60
R25	X,60
R26	X,65
R27	W,65
R28	K,48
R29	L,49
R30	G,22
R31	K,23
R32	G,28
R33	G,67
R34	K,27
R35	H,26
R36	J,30
R37	H,25
R38	L,27
R39	T,18
R40	S,10
R41	N,9
R42	M,13
R43	M,23
R44	J,19
R45	G,17
R46	H,12
R47	U,27
R48	O,16
R49	P,23
R50	N,24
R51	P,17
R52	U,25
R53	H,13
R54	J,6
R55	F,8
R56	J,8
R57	R,29
R58	U,33
R59	T,36
R60	T,38
R61	T,39
R62	L,44
R63	X,47
R64	BB,51
R65	Y,72
R66	V,65
R67	G,50
R68	H,50
R69	W,20
R70	BB,50
R71	V,50
R72	O,51
R73	Z,46
R74	P,50
R75	S,48
R76	W,47
R77	R,44
R78	W,44
R79	T,41
R80	O,42
R81	I,33
R82	J,33
R83	M,33
R84	N,33
R85	K,44
R86	AA,22
R87	W,14
R88	W,9
R89	Q,62
R90	T,61
R91	N,67
R92	N,60
R93	Q,56
R94	H,33
R95	F,48
R96	Z,16
R97	Z,14
R98	AA,17
R99	AA,20
R100	H,23
R101	Z,15
R102	AA,8
R103	AA,13
R104	DD,8
R105	Y,10
R106	X,11
R107	D,47
R108	X,14*
R109	W,8 *
R110	S,7
VR1	L,17
VR2	K,13
VR3	R,17

Test Points	
TP1	Y,68
TP2	U,18
TP3	V,11
TP4	Y,22
TP5	X,41
TP6	Y,42

*Parts on opposite side of PC Board and therefore not visible

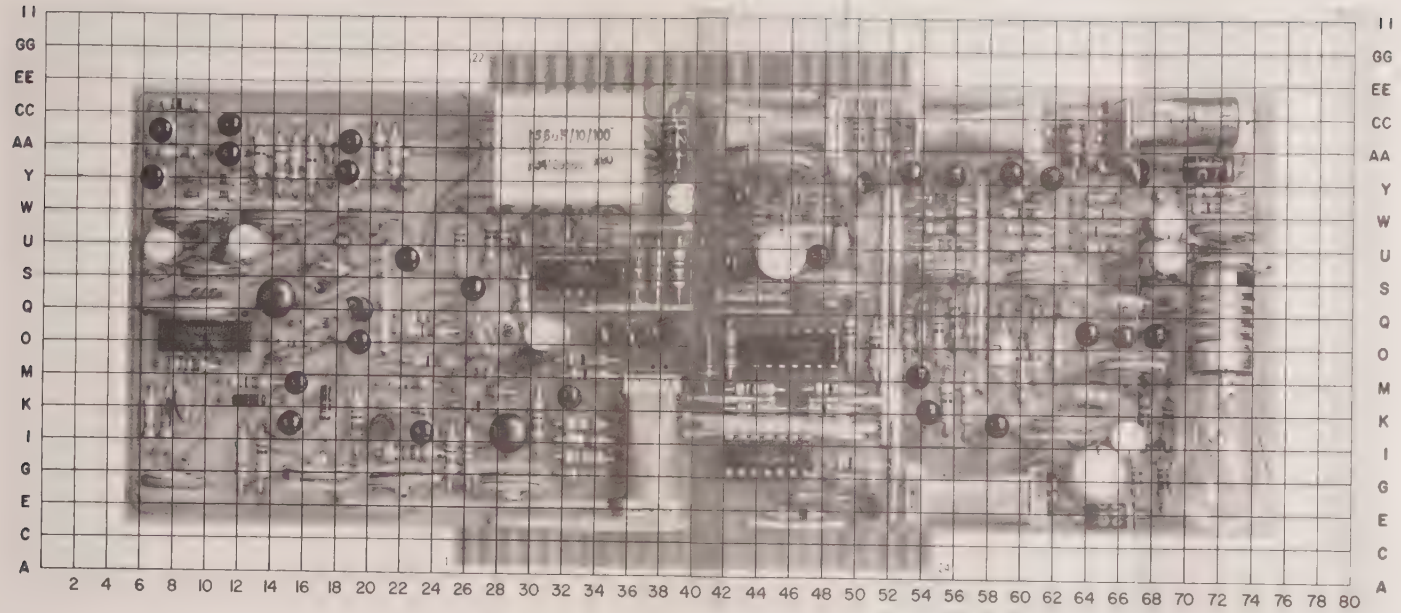


Figure 6-4. Parts Location Assembly A5 (REV J)

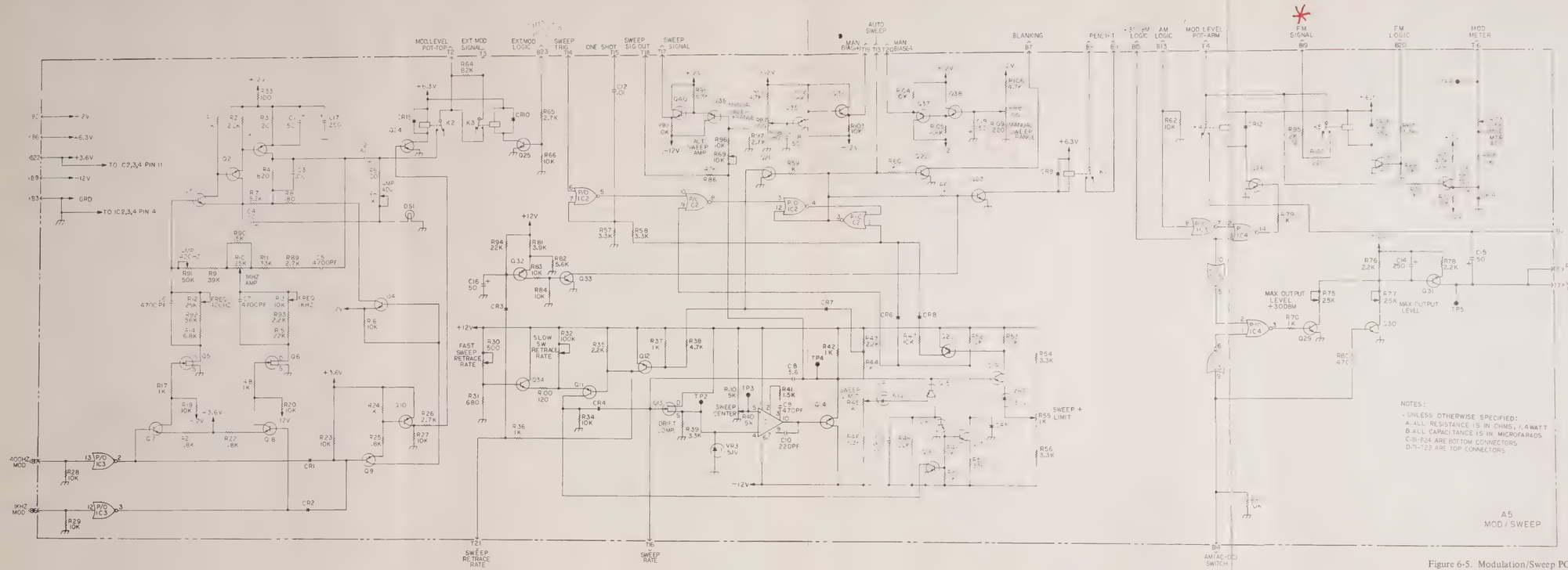


Figure 6-5. Modulation/Sweep PC Board A5, Schematic Diagram

6.9 PROGRAMMABLE FREQUENCY DIVIDER.

(Low Speed Divider PC Board A6, and High Speed Divider PC Board A7.)

6.9.1 Programmable Frequency Divider, Circuit Description.

Low Speed Divider PC Board (A6) and High Speed Divider PC Board (A7) together make up the Programmable Frequency Divider (PFD).

Input frequencies in the range 20.000 to 29.999 MHz (from a VCO on A8) are divided down by a factor of 20,000 to 29,999 called the division ratio to give a fixed output frequency of 1 kHz.

The division ratio is determined by the setting of the units MHz, hundreds kHz, tens kHz and units kHz frequency controls on the front panel. The last four digits of the division ratio are the same as the respective settings of these frequency controls.

The PFD consists of five series connected divider stages. With all frequency controls set to "0", the first four stages produce one output pulse for each ten input pulses, i.e., divide by ten. The last stage always gives one output pulse for every two input pulses. When the frequency controls are set to 0000, the last stage gives one output pulse for each 20000 input pulses to the first stage, and so the division ratio is 20,000. However, if, for example, the units kHz frequency control is set to 5, the first stage of the PFD is made to absorb five, and only five, input pulses for each output pulse from the last stage. Thus, there would be one pulse from the last stage for each 20,005 pulses into the first stage. If, in addition, the tens MHz frequency control were set to 5, the second stage would absorb five, and only 5, of its input pulses, corresponding to 50 input pulses to the PFD. The division ratio would now have increased to 20,055. In a similar way, the hundreds kHz and units MHz frequency controls increase the division ratio in multiples of 100 and 1000 respectively.

The pulse absorption takes place in the following manner. At the start of the division sequence, the first four divider stages start at "zero" and each provides one output pulse for every ten input pulses until a total of 10,000 input pulses are counted. This is phase I of the count cycle. At this time a flip-flop is set and this change of state initiates a Phase II sequence which causes each stage to increase its count capability so that the PFD will now count from 10,000 to 19,999 additional pulses depending upon frequency control settings. At the end of this count, the output flip-flop resets, the PFD provides a single output pulse, and the entire sequence repeats. The total PFD count will then be 20,000 to 29,999 counts per total sequence as selected by the frequency controls.

After the Phase I count of 10,000 all counters will be in their "zero" state again, and proceed to count upwards.

Each decade is then made to receive 10 to 19 pulses instead of the usual 10, before giving an output. This happens only once for each 20,000 to 29,999 input pulses. It happens first in the 10 kHz decade followed by the 100 kHz, 1 MHz and 1 kHz decades respectively. As each 10 kHz, 100 kHz or 1 MHz decade reaches the count of '9', it is reset backwards by the selected number of counts, before resuming the normal counting mode.

In the case of the 1 kHz decade (located on the High Speed Divider PC Board (A7), the procedure is slightly different. When the lower decades reach their next to last count, a pulse is generated, the 9th Count, which causes the 1 kHz decade to reset to the 'zero' state.

6.9.2 Low Speed Divider PC Board A6, Detailed Description.

NOTE

In the following discussion, prefix all reference designators with A6, unless otherwise specified.

The Low Speed Divider PC Board (A6) contains three programmable decade counter stages and a fixed divide by two stage. The tens kHz, hundreds kHz and units MHz controls on the front panel provide binary coded decimal (BCD) inputs to their respective decades. These inputs are decoded and used to control the division ratio of the programmable frequency divider.

The low speed divider operates in its simplest mode when the control lines are all low, corresponding to front panel frequency control settings of zero. In this case, each decade gives one output pulse for every ten input pulses it receives. Thus, because the stages are in series, the last decade gives one output pulse for every 1000 input pulses. This pulse rate is further divided by two in the binary stage. The outputs of all four divider stages are gated to produce one output pulse for every 2000 input pulses to the low speed divider to produce the minimum division ratio of 2000. The sequence of the states of the four binary stages in each decade is shown in figure 6-6.

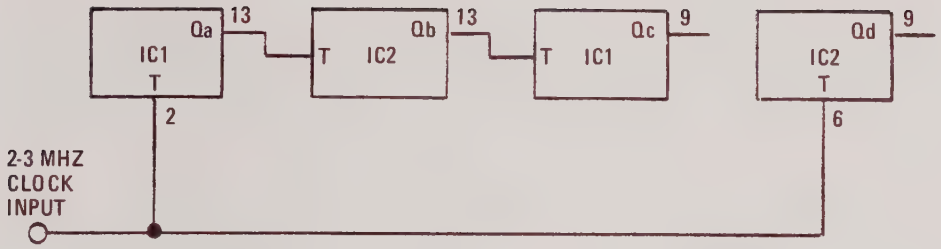
The three programmable decade counter stages are identical in their operation, and so only the detailed description of the operation of the tens kHz decade will be given.

Refer to the schematic diagram, figure 6-8. The initial state of the counter is 0110, as shown in figure 6-6. After 1000 input pulses of the 2–3 MHz input on XA6-23, there will be a pulse output from IC25-8 initiating Phase II. This toggles IC28 and IC28-9 goes low. This low level is applied to IC8-2. Consider the case for a setting of 5 on the 'tens' kHz control. In this condition IC8-1 is low (as it is for all non-zero settings). Thus when IC8-2 goes low, IC8 switches and IC8-14 goes low. This enables IC9-13 to go high when IC9-2 goes low, as it does when clock pulse 7 occurs and the decoded count provides a pulse via IC3 and IC4-5. The high on IC9-13 now holds IC7-8, the output of this decade, at a low level. It also clears IC8-12. The next clock pulse (8) causes IC2-8 to go low, and because IC7-1 is already low, IC9-7 goes low. As will be shown later IC9-5 is normally high, and thus when the next clock pulse (9) occurs on IC9-6, IC9-8 is set low.

The setting of IC9-8 and -9 initiates a series of events:

a. The counter, consisting of IC1 and IC2 is reset to a state corresponding to the setting of the frequency control for the tens kHz decade, in this case 5. The state to which the counter is reset is shown in figure 6-6 for all settings of the frequency control.

b. When IC9-8 goes low IC8-9 is set high by the trigger signal on IC8-6, arriving via IC5-8 or IC5-5, depending on the control setting.



CLOCK PULSE	Qa	Qb	Qc	Qd	CONTROL KNOB SETTING									
					0	1	2	3	4	5	6	7	8	9
0	0	1	1	0										R
1	1	1	1	0									R	
2	0	0	0	0								R		
3	1	0	0	0							R			
4	0	1	0	0						R				
5	1	1	0	0					R					
6	0	0	1	0				R						
7	1	0	1	0			R							
8	0	1	1	1		R								
9	1	1	1	1	R									

R = CLOCK PULSE 9 RESETS COUNTER TO THIS STATE

Figure 6-6. Low Speed Divider Counter Sequence

c. The high on IC8-9 clears IC9-13 to low, and IC9-14 goes high.

d. The low on IC9-13 opens the output gate, IC7-8, to pulses from the counter.

e. The high on IC9-14 clears IC9-9 to a low.

At this point the reset circuitry is back in its original condition, and the counter has been reset backwards by 5 counts. Thus, by the time another output pulse appears from IC7-8, 15 clock pulses will have entered at XA6-23, instead of the normal 10. In this way, 1,005 pulses will have been counted before IC25-8 again goes high, and toggles IC28 back to its initial state with a high level on IC28-9. The sequence is then repeated. Thus between successive high levels on IC28-9, 1000 plus 1,005 pulses will have entered the low speed divider, giving an overall division ratio of 2,005.

In a similar manner, settings of 5 on the hundreds kHz and units MHz controls, would increase the overall division ratio by 50 and 500 by counting 1000 plus 1050 and 1000 plus 1500 respectively.

It was indicated earlier that IC9-5 is normally high, and this is brought about in the following manner. IC28-6 is normally being triggered at a rate of 2 kHz when the 20–30 MHz loop is locked. Thus IC28-8 produces a squarewave at a frequency of 1 kHz. This is buffered by IC22, which drives a detector consisting of C7, CR1 and R16. IC22-13 is then always positive, IC22-5 is always high, and so, therefore, is IC9-5. This circuitry is incorporated to prevent a latch-up condition, which would occur if IC9-9 and IC9-13 were high at switch-on, thus preventing any output from the counter. However, this would then cause IC9-5 to be low, and the input clock would toggle IC9-6. The resulting sequence would reset IC9-13 and allow the counter to operate normally. A similar process operates in the other programmable divider stages and eventually IC28 will toggle, and the divider will then operate normally.

The reset circuitry consists of gates IC3 through 6, decoding the control lines, and controlled by reset flip-flop outputs IC9-8 and IC9-9, and by IC7-14. For a control setting of 5, input pins XA6-4, -3, -2 and -6 are at logical 1, 0, 1, 0 respectively, and these are decoded by the gates to which they are connected. It will be seen from figure 6-6, when clock pulse 9 occurs, the counter state 0111 must change to 0100. This achieve this, Qa is prevented from toggling by the high on IC3-10. Qb does not change because its T and Cd inputs do not change. Qc is reset by the high on IC5-14, caused by the low on IC7-14 after clock pulse 8. Qd is reset by the high on IC5-8, occurring after clock pulse 9 produces a low on IC9-8. Decoding of the inputs and resetting of the counter are carried out in a similar manner for other settings of the front panel frequency controls.

The 9th Count pulse is produced by decoding in IC29 the states of the three decade stages and the divide-by two. When the low speed divider is one count short of its final count, there will be a pulse out at XA6-21, the 9th Count pulse. This pulse is used in the High Speed Divider PC Board (A7), to initiate a reset cycle there, as explained in the theory of operation for that assembly.

6.9.3 Low Speed Divider PC Board A6, Test Data.

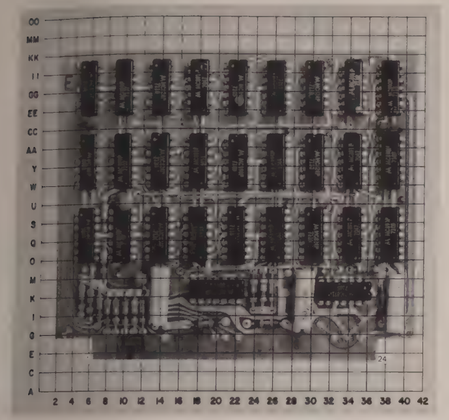
NOTE

In the following tables, measurements were made with an Eldorada 1650 Frequency Counter. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend either Low Speed Divider PC Board A6 or High Speed Divider PC Board A7, as required from the RF-808 main frame. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Refer to figures 6-7 and 6-8 for test points, component locations and schematic diagrams.

TABLE 6-8. A6 LOW SPEED DIVIDER FREQUENCY CHART

TEST POINT	FREQUENCY (kHz)	REMARKS (MHz)
		(RF-808 Frequency controls set to –)
TP1	200.0	20.000
	200.1	20.010
	200.2	20.020
	200.3	20.030
	200.4	20.040
	200.5	20.050
	200.6	20.060
	200.7	20.070
	200.8	20.080
	200.9	20.090
TP2	20.0	20.000
	20.1	20.100
	20.2	20.200
	20.3	20.300
	20.4	20.400
	20.5	20.500
	20.6	20.600
	20.7	20.700
	20.8	20.800
	20.9	20.900
TP3	2.0	20.000
	2.1	21.000
	2.2	22.000
	2.3	23.000
	2.4	24.000
	2.5	25.000
	2.6	26.000
	2.7	27.000
	2.8	28.000
	2.9	29.000
TP4	1.0	(RF-808 set to any frequency)



A6

REF DESIG	LOCATION
C1	J,29
C2	K,14
C3	J,39
C4	DD,5
C5	CC,38
C6	M,12
C7	U,10
CR1	T,8
IC1	HH,22
IC2	HH,18
IC3	HH,26
IC4	HH,11
IC5	HH,14
IC6	HH,5
IC7	HH,30
IC8	HH,38
IC9	HH,34
IC10	Z,22
IC11	Z,18
IC12	Z,26
IC13	Z,9
IC14	Z,14
IC15	Z,5
IC16	Z,30
IC17	Z,38
IC18	Z,34
IC19	R,22
IC20	R,18
IC21	R,26
IC22	R,9
IC23	R,14
IC24	R,5
IC25	R,30
IC26	R,38
IC27	R,34
IC28	L,33
IC29	L,20
L1	H,25
L2	H,19
L3	K,38
R1	L,26
R3	L,25
R5	L,24
R7	J,10
R8	J,12
R9	J,8
R10	J,9
R11	K,5
R12	K,6
R13	J,7
R14	J,11
R15	N,36
R16	O,8

Test Points

TP1	CC,28
TP2	U,28
TP3	N,31
TP4	U,40
TP5	M,10

Figure 6-7. Parts Location, Assembly A6 (REV J)

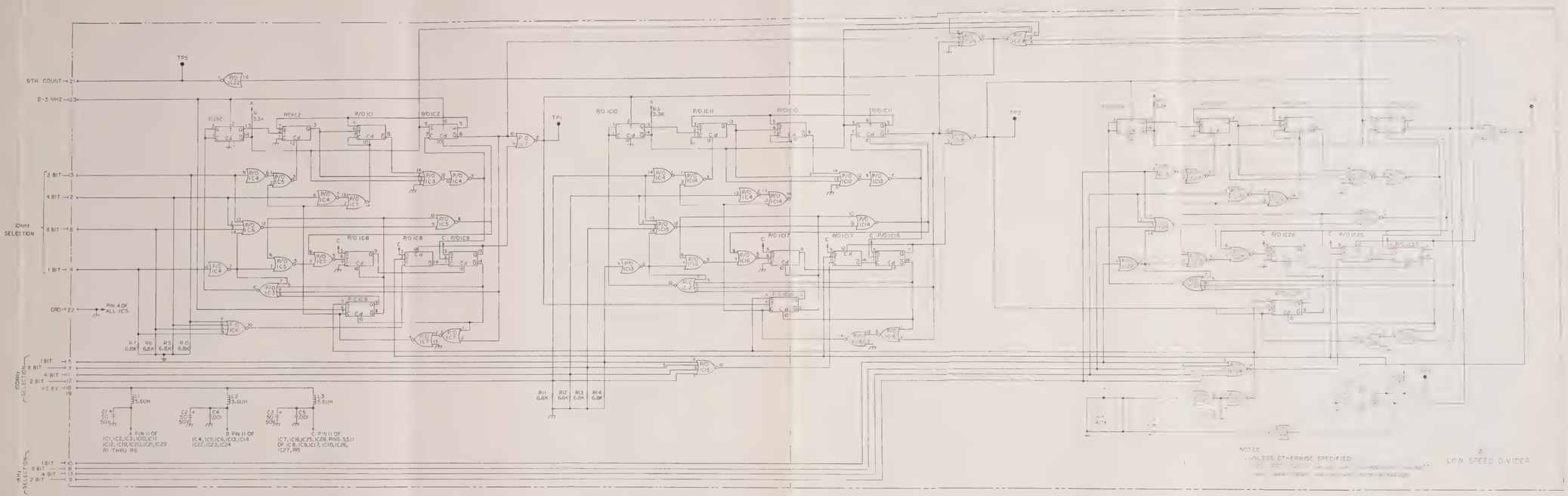


Figure 6-8. Low Speed Divider Board A6, Schematic Diagram

6.9.4 High Speed Divider PC Board A7, Detailed Description.

NOTE

In the following discussion, prefix all reference designators with A7, unless otherwise specified. Refer to figure 6-11.

The High Speed Divider PC Board (A7) consists basically of four functional blocks; a five-stage switch-tail ring counter using IC's 2 through 6; decoding gates, IC's 12 through 16; comparison gates, IC's 7 through 11 and reset circuitry, consisting of IC's 20 through 23.

Assume the units kHz control is set to 0. For this setting the High Speed Divider operates simply as a divide-by 10 circuit. The 20–30 MHz input is on pin 9. It is inverted in IC1 and then clocks the five-stage counter. Referring to figure 6-9 it can be seen that the output of each counter stage is alternately 1 (for 5 clock periods) and 0 (for five clock periods), and so the output frequency is one-tenth of the input. It thus lies in the range 2–3 MHz.

The Q and $\overline{Q}$ outputs of IC5 and IC6 respectively go to IC18, and IC18-10 goes high on the count of 9. The duration of this high level is one period of the 20–30 MHz clock. The high on the emitter of Q5 is stretched by the action of C4, in order to provide a wider clock pulse on pin 2 for the slower logic used in the Low-Speed Divider. The latter consists of three decade and one binary dividers in series. When this divider reaches its next to last count, it generates a negative-going pulse called the 9th Count on XA7-4, and IC18-6 then goes low.

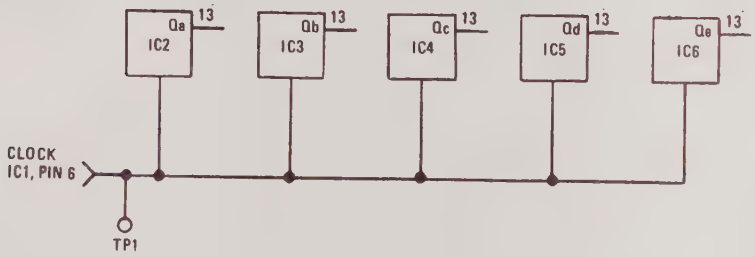
When the high speed divider reaches its next to last state, count 8, IC18-8 and IC18-15 go low also. IC18-9 goes high and primes the D2 input of IC23. The next clock pulse (9) from IC1-8 then sets Q of flip-flop IC23 to 1. IC23 is connected as a monostable and after 5 microseconds, determined by R13 and C5, it resets itself on pin 8. The pulse from Q23 is fed via C6 and IC19 and appears on XA7-5 as a positive going End Of Count pulse. In this way the End Of Count pulse starts at the same time as the 20–30 MHz clock pulse and is not subject to the propagation delay time of the dividers.

When IC18-9 went to logic 1 it also set $\overline{Q}$ of IC20 to logic 0, and this level inhibits gates IC7 through 11, which are comparison gates normally used to initiate a reset cycle.

IC18-1 is at logic 0 when the units kHz control is at 0. IC18-2 goes to 0 when IC23 is in the '1' state for the duration of the End Of Count pulse, and thus IC18-4 goes to logic 1 and resets IC20 through IC11-8. The inhibit level is then removed from comparison gates IC7 and 11 and the counting sequence repeats.

If the units kHz control is not set to 0, one of the kHz selection lines will be at logic 1 corresponding to the binary number selected. These lines then operate on the decoding gates to produce a logic '0' at one of their outputs, corresponding to the frequency control setting; on IC16-6 when set to 0, progressing from left to right on the schematic as the setting increases to 9. For settings of the units kHz control other than 0, a decode, enable, reset sequence is initiated as shown in figure 6-9. The comparison gates, IC9 through 11, are arranged to detect a count of 2 less than the indicated setting (decode). When this state is reached, after the arrival of the End OF Count pulse from the low speed divider, the next clock pulse enables the reset circuitry, and the succeeding clock pulse resets the counter, in the desired count period.

For example, if the units kHz control is set to 5, decoder IC15-8 will be low, and the other decoder outputs will be high. On the 9th Count from the low speed divider, and the next to last count (caused by clock pulse 8) of the high speed divider, pins 5, 6 and 8 of IC18 are low. IC18-9 goes high, and primes IC23, which is triggered ON by the next clock pulse (9). IC20 is also set on clock pulse 8, IC20-1 goes low, enabling the comparison gates. This time, the pulse from $\overline{Q}$ of IC23 does not reset ± IC20 because IC18-1 is high. IC10-1 and -2 are both low on the next count of 3, IC10-5 goes high and primes D1 of IC21. The next pulse (4) sets IC21 and the high on IC21-5 inhibits the output gate, on IC18-11 and the J, K inputs of IC's 3, 4, 5 and 6. This prevents the latter from being triggered by the next clock pulse and allows an unambiguous reset on the succeeding clock pulse, (5). When IC21 is set, the low on IC21-6 primes IC22 which is then set on the next clock pulse (5). The output of IC22 then resets the counter to the zero state. It is also returned to its own J, K and R inputs, and thus resets itself approximately 10 nanoseconds after being set. This narrow pulse also resets IC21 on pin 8, and IC20 on pin 12, via R4 and IC11. After being reset, the counter receives 10 more pulses before giving an output. In this way the counter received a total of 15 pulses for this output and so the overall division ratio was increased by 5.

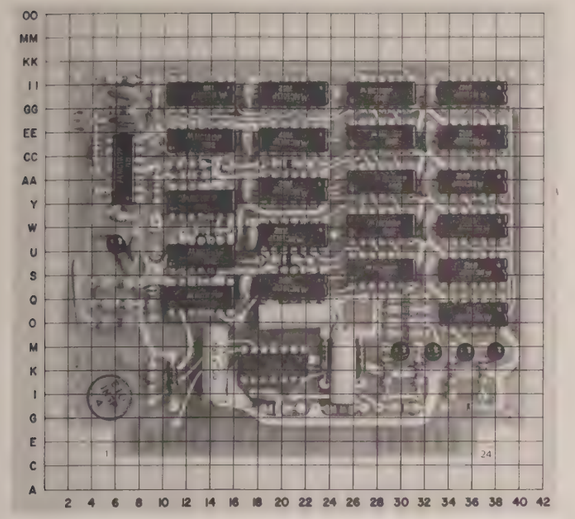


CLOCK PULSE	Qa	Qb	Qc	Qd	Qe	SETTING OF 'UNITS' KHZ CONTROL 1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	E	D							
1	1	0	0	0	0	R	E	D						
2	1	1	0	0	0		R	E	D					
3	1	1	1	0	0			R	E	D				
4	1	1	1	1	0				R	E	D			
5	1	1	1	1	1					R	E	D		
6	0	1	1	1	1						R	E	D	
7	0	0	1	1	1							R	E	D
8	0	0	0	1	1								R	E
9	0	0	0	0	1	D								R

OUTPUT INHIBITED HERE

D = DECODE THIS STATE
E = ENABLE RESET ON THIS CLOCK PULSE
R = RESET Qa – Qe TO 00000 STATE ON THIS CLOCK PULSE

Figure 6-9. High Speed Divider Counter Sequence.



A7

REF DESIG	LOCATION
C1	O,20
C2	K,25
C3	HH,7
C4	U,8
C5	FF,7
C6	Q,3
C7	K,14
C8	I,19
C9	V,17
C10	Z,17
C11	DD,17
C12	HH,17
C13	HH,32
C14	EE,32
C15	AA,32
C16	W,32
C17	S,32
C18	R,17
C19	X,7

IC1	Q,14
IC2	R,22
IC3	V,22
IC4	Z,22
IC5	DD,22
IC6	HH,22
IC7	S,28
IC8	W,28
IC9	AA,28
IC10	EE,28
IC11	HH,28
IC12	S,36
IC13	W,36
IC14	AA,36
IC15	EE,36
IC16	HH,36
IC17	O,36
IC18	HH,14
IC19	K,20
IC20	DD,14
IC21	Y,14
IC22	U,14
IC23	CC,7

L1	L,24
L2	L,27
L3	J,11
Q1	M,38
Q2	L,35
Q3	M,30
Q4	L,33
Q5	V,6
R1	H,36
R2	H,30
R3	H,19
R4	BB,20
R5	T,20
R6	W,14
R8	H,25
R9	JJ,7
R10	GG,9
R11	O,6
R12	DD,4
R13	GG,6
R14	Q,6

R15	R,9
R16	R,6
R17	J,9
R18	Z,9
R19	AA,12
R20	BB,13
R21	K,35
R22	K,34
R23	K,29
R24	K,32
R25	N,30
R26	Q,30
R27	P,30
R28	O,30

Test Points

TP1	O,16
TP2	U,9
TP3	BB,16
TP4	W,9
TP5	DD,9
TP6	Z,4

Figure 6-10. Parts Location, Assembly A7.

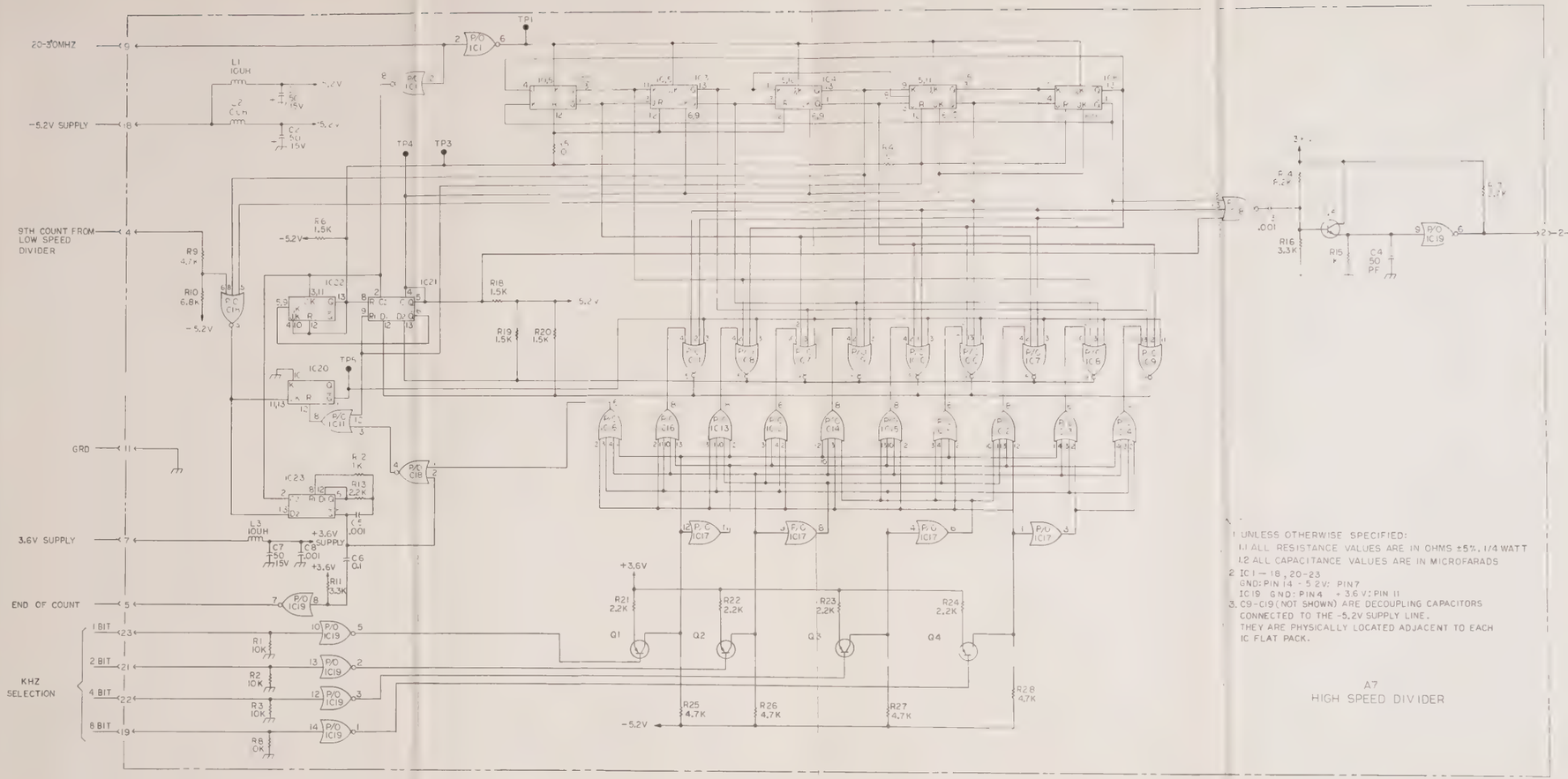


Figure 6-11. High Speed Divider PC Board A7 Schmatic Diagram

6.10 20–30 MHZ OSCILLATOR PC BOARD A8.

6.10.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with 20–30 MHz Oscillator PC Board reference designator A8, unless otherwise specified.

The 20–30 MHz VCO (A8) supplies the 20 to 29.9999 MHz signal used in the 270–280 MHz phase-locked loop. The board contains two VCO's, one covering a range of 20 to 25 MHz, the other 25 to 30 MHz. The oscillator in use, is determined by the front panel 'units' MHz control. The oscillator itself is part of a phase-locked loop consisting of boards A6, A7, A8 and A9, which is locked to the 1 MHz standard in increments of 1 kHz, as determined by the front panel frequency controls.

In addition to the oscillators, the board contains a binary-coded-decimal to 10-line decoder for pre-tuning the oscillators, a fixed current sink, an output buffer, and a control line filter.

Refer to schematic diagram figure 6-13. The low-range oscillator circuit is that associated with Q15, the high-range with Q16 (FET's are used for stability and signal purity). The two circuits are identical except for the values of the frequency determining components, which for Q15 are L3, CR9, CR10 and C19. CR11 controls the oscillation amplitude. L8 is an RF choke and is in the DC return for the source current, which flows through Q18 to ground. CR12, R60 and

A9 thus controlling the voltage established at TP2. Q23 and its associated circuitry comprise a voltage regulator setting the voltage on TP4 to −10.7 volts. Thus, the preset current sets a voltage on TP2 to tune the proper oscillator to its approximate desired frequency and the LOCK SIGNAL voltage varies the TP2 voltage to bring the oscillator to its final place locked frequency.

The control voltage on TP2 is passed thru a 1 kHz notch filter A2 which further removes any residual 1 kHz signal remaining on the LOCK SIGNAL. The control voltage is then applied through L7 to the voltage-variable capacitance diodes CR4 and CR10, thus presetting the oscillator frequency. In this example, the cathodes of CR1 through 5 are low and hence Q17 is off, which allows Q18 to turn on, and complete the ground return for the low-range oscillator. When Q18 is on, Q19 is off and so the high-range oscillator is off. For units MHz settings of 5 through 9, the cathodes of CR1 through 5 are high and Q17 turns on. This turns Q18 off and Q19 on, thus activating the high range oscillator.

The oscillator output is applied to the high input impedance source follower Q20 and through emitter follower Q21 to the squaring circuit on IC2. One output feeds the mixer in the 270 to 280 MHz phase locked loop (PLL), A14. The other drives the high speed driver (A7). Resistor R48 together with R46 and R49 provides a preset bias for CR9 and CR10 in order to set the tracking range of the oscillator.

6.10.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position prior to removing or replacing printed circuit board A8.

a. Remove printed circuit board A8 (paragraph 5.3.9).

b. Extend board A8 from main frame with Extender Board 808-0170.

c. Perform initial turn-on procedures (paragraph 3.3).

d. Connect a digital voltmeter (DVM) to A8R48 wiper and adjust A8R48 for a reading of +9.30 VDC. (Refer to figure 6-12).

e. Connect the DVM to the wiper of A8R65 and adjust for a reading of +9.80 VDC.

f. Place RF-808 power ON/OFF switch to OFF. Isolate lead to connector pin A8-3. Adjust the DC Supply for +2.500 VDC and connect the (+) lead to connector pin A8-3.

g. Energize RF-808. Connect a frequency counter to connector pin A8-19.

h. Set RF-808 units MHz control to 4. Squeeze or spread the turns of coil A8L3 to obtain a frequency reading of 24.490 MHz ± 1 kHz.

i. Set units MHz control to 0. Adjust A8R48 for an output frequency of 20.490 MHz ± 1 kHz.

j. Reset units MHz control to 4. Frequency counter should now indicate 24.490 MHz ± 5 kHz. If not, repeat steps i and j until specified reading is obtained.

k. Coat A8L3 coil winding with clear urethane to prevent coil winding from changing position.

l. Set units MHz control to 9. Squeeze or spread the turns of coil A8L4 to obtain a frequency reading of 29.490 MHz ± 1 kHz.

m. Set units MHz control to 5. Adjust A8R65 for an output frequency of 25.490 MHz ± 1 kHz.

n. Reset units MHz control to 9. Frequency counter should now indicate 29.490 MHz ± 5 kHz. If not, repeat steps n and p until specified reading is obtained.

o. Coat A8L4 coil winding with clear urethane to prevent coil winding from changing position.

6.10.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend 20–30 MHz Oscillator PC Board A8 from the RF-808 main frame. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Where conditions are not specified, the RF-808 control settings and mode of operation will not affect the resultant data. Refer to figure 6-12 for test points and component locations and figure 6-13 for the assembly schematic diagram. Prefix all reference designators in the following tables with A8.

TABLE 6-9. A8 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	0	+0.6	.04	
Q2	0	0	+10.5	
Q3	0	+0.1	+10.5	
Q4	0	+0.7	+10.5	5.000 MHz CW mode
Q5	0	+0.1	+10.5	SWEEP OFF, 0 dBm
Q6	+10.5	+9.8	+10.5	
Q7	+10.5	+10.5	+6.3	
Q8	+10.5	+10.5	+6.3	

TABLE 6-9. A8 TRANSISTOR VOLTAGE CHART (Cont)

REF DESIG	VOLTS DC (NOMINAL) EMITTER	BASE	COLLECTOR	REMARKS
Q9	+10.5	+10.5	+6.3	
Q10	+10.5	+10.5	+6.3	
Q12	−9.2	−8.7	0	
Q13	−9.7	−9.2	+6.3	
Q14	−8.2	−7.6	+6.3	
Q15	+11.1	+6.0	0	
Q16 FET	+11.1 (Source)	+1.6 (Drain)	0 (Gate)	5.000 MHz, CW mode,
Q17	0	+0.7	0	SWEEP OFF, 0 dBm
Q18	0	0	+5.9	
Q19	0	+0.7	0	
Q20	+11.3	+1.4	0	
Q21	+2.1	+1.4	0	
Q22	+10.5	+11.1	+11.9	
Q23	−10.5	−11.2	−12.0	

TABLE 6-10 A8 INTEGRATED CIRCUIT DC VOLTAGE CHART
(Voltages are nominal unless otherwise specified)

REF DESIG	PIN 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IC1	+0.1	+0.1	+0.1	0	+2.9	+0.1	+0.1	+0.1	+0.1	+0.1	0	+3.6	+4.6	0	+3.6	+0.07
IC2	−1.2	−1.2	−1.1	−1.6	−1.6	−1.2	−5.6	−1.6	−1.2	−1.2	−1.0	−1.2	−1.2	0		
IC3																
IC4																
IC5																

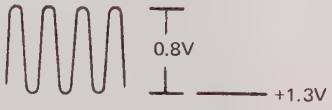
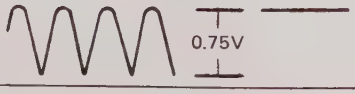
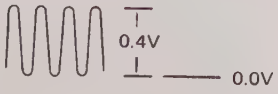
TABLE 6-11. A8 TEST POINT AND CONNECTOR PINS VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
TP-1	−0.1	
TP-2	+6.3	
TP-3	+10.5	
TP-4	−10.5	
Connector Pins		5.000 MHz, CW mode,
2	0	SWEEP OFF, 0 dBm
3	−0.1	
4	–	
5	–	
6	–	
7	−5.2	

TABLE 6-11. A8 TEST POINT AND CONNECTOR PINS VOLTAGE CHART (Cont)

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
8	0	5.000 MHz, CW mode, SWEEP OFF, 0 dBm
9	0	
10	+3.6	
11	–	
12	+3.6	
13	–12.0	
14	0	
15	–	
16	–1.1	
17	–	
18	–	
19	0	
20	–	
21	–	
22	+12.0	
23	0	

TABLE 6-12 A8 WAVEFORM DATA CHART

TEST POINT	WAVEFORM
Connector Pin 3	* Amplitude varies when unlocked. Typical out of lock waveform at pin 3 of connector fo = 1 kHz –0.1 VDC when system is locked, with output frequency of 5.000 MHz
Q16 (Source)	fo = 25 MHz
Q16 (Drain)	 fo = 25 MHz
Q16 (Gate)	 fo = 25 MHz
Q19	 fo = 25 MHz

PARTS LOCATION GUIDE FOR FIGURE 6-14, ASSEMBLIES A8A1 & A8A2

A8A1

REF DESIG	LOCATION
C1	G,34
C2	Q,16
C3	T,15
C7	EE,24
C10	G,23
C11	M,20
C12	P,20
C15	M,29
C16	I,38
C17	HH,30
C18	T,28
C19	CC,27
C20	X,24
C21	U,27
C22	DD,30
C23	X,29
C24	S,26
C25	T,35
C26	GG,37
C27	T,31
C28	X,32
C29	DD,34
C30	Z,37
C31	U,35
C32	X,36
C33	O,38
C34	J,32
C35	G,25
C36	F,30
C41	N,32
CR1	N,7
CR2	M,7
CR3	L,7
CR4	K,7
CR5	I,7
CR9	DD,25
CR10	BB,28
CR11	Z,29
CR12	V,27
CR13	EE,34
CR14	DD,36
CR15	Z,36
CR16	V,34
IC1	K,11
IC2	H,28
L1	H,32
L2	H,21
L3	AA,26
L4	AA,34
L5	U,25
L6	U,32
L7	EE,27
L8	Y,23
L9	EE,31
L10	S,34
L11	F,18
Q1	U,6
Q2	U,9
Q3	T,13
Q4	U,11
Q5	U,4
Q6	Z,5
Q7	Y,12
Q8	Z,7
Q9	Z,9
Q10	Y,14
Q12	FF,15
Q13	FF,18
Q14	CC.19
Q15	X,26
Q16	X,34
Q17	N,27
Q18	R,23
Q19	S,29
Q20	M,36
Q21	J,35
Q22	BB,16
Q23	W,19
R1	M,17
R2	Q,14
R3	W,16
R4	Q,9
R5	M,15
R6	M,14
R7	Q,5
R8	Q,4
R9	Q,6
R10	Q,12
R11	Q,11
R12	Q,13
R13	Q,10
R14	Q,8
R15	Q,7
R16	W,4
R17	V,5
R18	W,11
R19	V,12
R20	W,13
R21	V,14
R22	W,8
R23	V,10
R24	W,6
R25	V,7
R26	HH,18
R27	H,18
R28	G,18
R29	J,18
R30	I,18
R31	EE,15
R32	FF,16
R33	FF,19
R34	Z,20
R35	Z,19
R36	BB,17
R38	M,25
R39	L,24
R41	K,23
R42	N,23
R43	T,21
R44	FF,27
R45	G,35
R46	L,32
R47	O,34
R48	HH,26
R49	GG,23
R50	AA,4
R51	AA,7
R52	Z,12
R53	AA,10
R54	BB,14
R57	DD,37
R58	J,29
R59	K,34
R60	W,29
R61	Q,30
R62	R,25
R63	S,23
R64	U,23
R65	HH,34
R66	FF,32
R67	S,36
R68	W,37
R69	R,35
R70	S,27
R71	M,38
R72	L,37
R73	Z,16
R74	T,18

Test Points

TP1	HH,13
TP2	HH,4
TP3	BB,11
TP4	Y,18

A8A2

REF DESIG	LOCATION
C1	FF,5
C2	GG,9
C3	FF,11
R1	DD,6
R2	DD,11
R3	CC,8
R4	CC,4
R5	CC,13
R6	DD,9

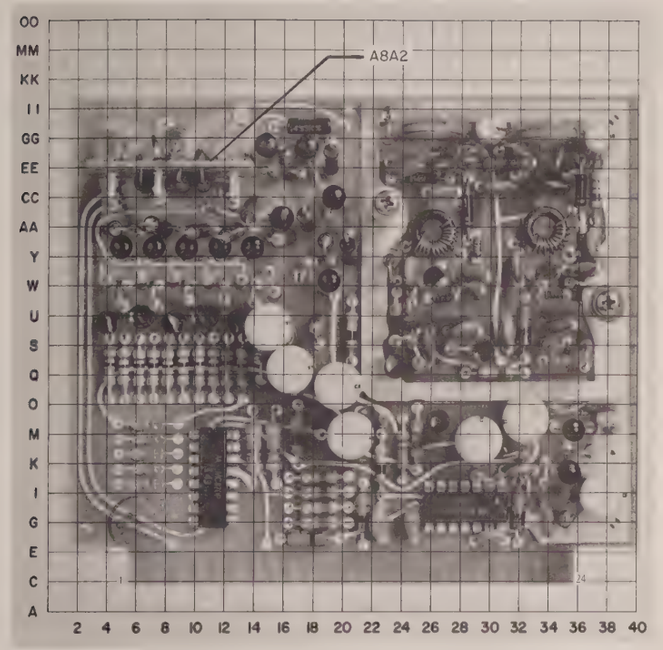


Figure 6-12. Parts Location, Assembly A8 (REV F)

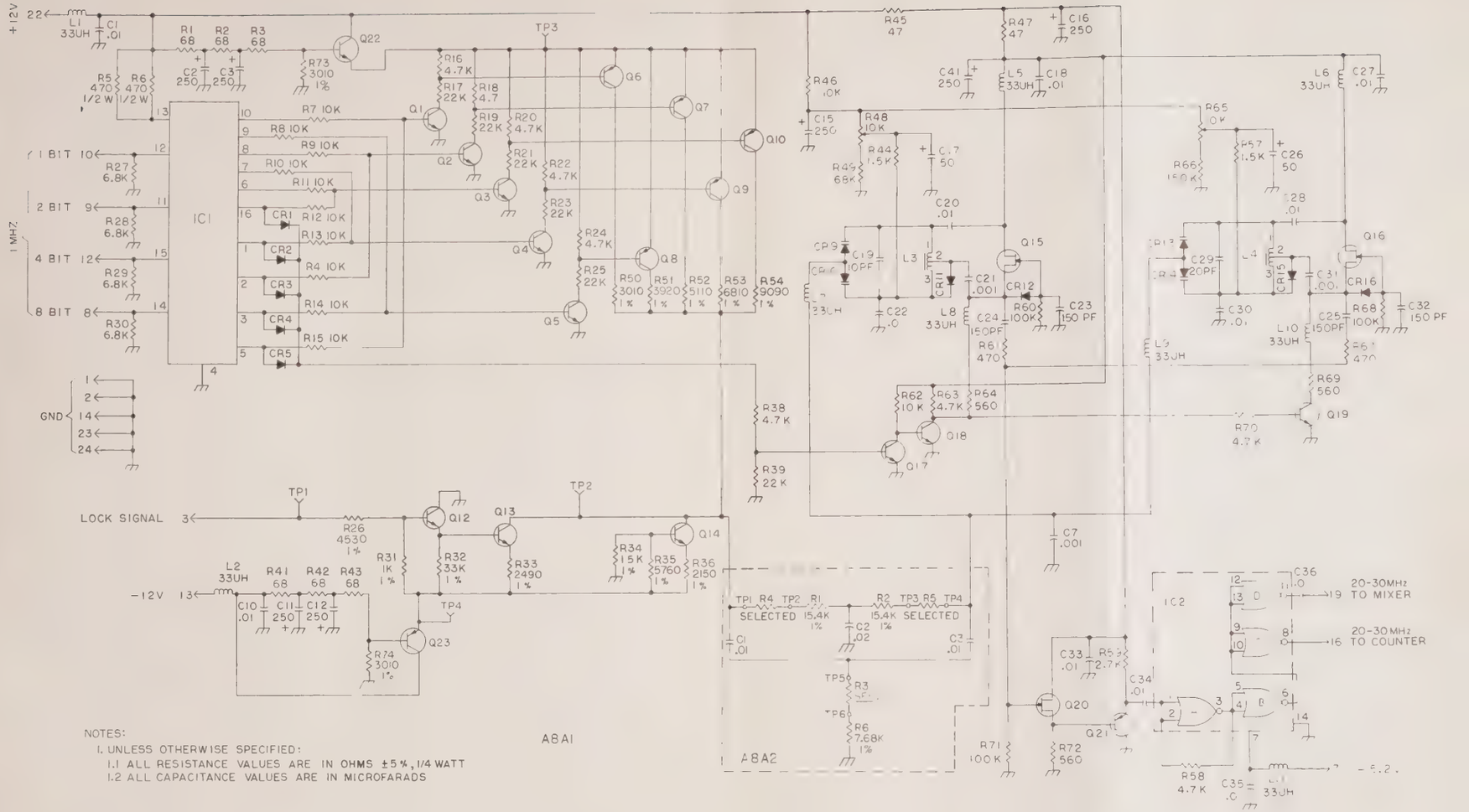


Figure 6-13. 20–30 MHz Oscillator PC Board A8, Schematic Diagram.

6-49/6-50

6.11 SWEEP/SAMPLE AND HOLD PC BOARD A9.

6.11.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Sweep/Sample and Hold PC Board reference designator A9, unless otherwise specified.

The Sweep/Sample and Hold PC Board (assembly A9) is a digital phase detector used in the 20 to 29.999 MHz phase locked loop. It compares a 1 kHz reference signal derived from the frequency standard with a 1 kHz signal derived from the High Speed Divider A7. The rising edge of the 1 kHz reference input initiates a positive going ramp with a slope of approximately 0.12 volts per microsecond. When the End Of Count pulse arrives from the high speed divider the ramp voltage is sampled, and held until the next sampling pulse from the high speed divider arrives. This sampled voltage is then used to control the frequency of the 20 to 29.999 MHz VCO on A8. The sampling pulse occurs at a nominal 1 kHz rate and as its timing approaches that of the reference 1 kHz, the sampled voltage will decrease until a point of equilibrium is reached. When this point is reached, the voltage holds the frequency of the VCO at an integral multiple of 1 kHz as determined by the front panel frequency controls.

Refer to schematic diagram, figure 6-15. The 1 kHz reference input is applied to pin 9. It is coupled through C11 to pin 1 of IC1. Gates with pin numbers 1, 2, 3 and 5, 6, 7 are connected as a bistable latch which is set, with pin 3 low, by the rising edge of the reference signal on IC1 pin 1. As a result Q5 is off, which holds Q2 off. This activates the current source comprising Q3, Q4, R7, R8, R9 and R10. The current flowing from the collector of Q4 charges C3 positively at a linear rate. While C3 is charging, the positive 5 microsecond wide End Of Count pulse arrives. Transistors Q9 through Q13 are turned on and the latch (IC1) is reset on pin 7 with pin 3 high. This turns on Q5 and Q2, which turns off the current source charging C3. The negative-going pulses on the collectors of Q11 and Q13 turn on Q16 and Q15 respectively. The voltage on C3 is then effectively transferred to C7 and C9. The voltage on C9 is buffered by Q17 and Q18 and appears as an output on pin 22.

When the End Of Count pulse terminates, Q15 and Q16 are turned off and, because of the high input impedance of Q17, C9 retains its voltage until the next pulse samples the voltage on Q3.

The positive pulse on the collector of Q12 during the sampling interval supplies a charge via C8 to the source of Q16 to balance that removed by the negative pulse on the gate acting through the gate-source capacitance.

When the reference input returns to zero, Q6 is turned on, which applies a positive signal to the cathode of CR1, allowing Q7 to turn on, with base drive supplied by R12. C3 then discharges through Q7 and Q8 to approximately −5 volts, established by the potential at the base of Q8. This is fixed by the potential divider R43 and R44 across the −12V line. The voltage at the junction of R43 and R44 is buffered by complementary emitter followers Q23 and Q22 and applied to the base of Q8. Q24 in conjunction with R45, R46 and C19 provides a low impedance return for R31 at approximately −6V DC.

The READY lamp on the front panel is controlled by an out of lock signal developed on this board. If the reference input signal on pin 9 fails, the voltage at the junction of CR6 and C14 falls to zero and Q20 turns off. Q21 turns on and holds the out of lock signal line at pin 21 close to ground, and the READY lamp is extinguished. This also happens if the End Of Count pulse does not appear during the time that the reference input is high indicating that the loop is not locked. When the reference input goes high, the latch is set with pin 3 of IC1 low. If the End Of Count pulse does not appear, pin 3 is still low when the reference returns to its low level. Thus pins 12 and 13 of IC1 are then low and pin 14 goes high which resets the latch through CR8, causing pin 14 to go low again. The narrow positive pulse which thus appears at pin 14 of IC1 triggers the monostable, consisting of IC1 pins 8 -9 -10, Q1 and Q19, with the time constant determined by R37 and C13. When the trigger occurs pin 8 of IC1 goes low for approximately 500 microseconds and this holds the lock signal line close to ground, causing the READY lamp to go out.

6.11.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position prior to removing or replacing modules and printed circuit board assemblies.

a. Remove printed circuit board A9 (paragraph 5.3.9). Extend board A9 from main frame using Extender Board 808-0170. Perform initial turn-on procedures (paragraph 3.3).

b. Set the RF-808 for a CW output frequency of 5.000 MHz at +10 dBm.

c. Connect a spectrum analyzer to the RF OUTPUT connector. Adjust the spectrum analyzer for a full screen display (10 dB/div) and adjust the bandwidth and scan width to measure the 1 kHz sidebands.

d. Adjust A9C8 (figure 6-14) to obtain a minimum 1 kHz sideband amplitude.

6.11.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend the Sweep/Sample and Hold PC Board A9 from the RF-808 main frame. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Where conditions are not specified, the RF-808 control settings and mode of operation will not effect the resultant data. Refer to figure 6-14 for test points and component locations and figure 6-15 for the assembly schematic diagram. Prefix all reference designators in the following table with A9.

TABLE 6-13 A9 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL) EMITTER	BASE	COLLECTOR	REMARKS
Q1	0	+0.8	+0.2	
Q2	+12.0	+11.1	+11.7	
Q3	+12.0	+11.8	+11.8	
Q4	+11.8	+11.7	−3.0	
Q5	0	+.07	+0.4	
Q6	+1.3	+1.0	−2.5	
Q7	−5.0	−4.7	−3.0	
Q8	−5.0	−5.5	−12.0	
Q9	0	+0.2	+11.7	
Q10	+11.7	+11.7	−12.0	
Q11	−12.0	−12.0	+11.6	
Q12	+11.8	+11.8	−11.8	
Q13	−12.0	−12.0	+11.6	
Q15 FET	−3.0 (Drain)	0 (Source)	+11.5 (Gate)	
Q16 FET	0 (Drain)	−1.1 (Source)	+11.5 (Gate)	
Q17 FET	+12.0 (Drain)	+0.3 (Source)	−1.1 (Gate)	
Q18	−0.3	+0.3	+12.0	
Q19	+0.8	+1.3	+3.5	
Q20	0	+0.2	0	
Q21	0	0	+3.5	
Q22	−5.5	−4.9	0	
Q23	−4.9	−5.5	−12.0	
Q24	−5.3	−6.0	−12.0	

TABLE 6-14 A9 INTEGRATED CIRCUIT VOLTAGE CHART

(Voltages are nominal unless otherwise specified)

REF DESIG	PIN 1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC1	0	+0.2	+1.3	0	+0.2	+1.3	+0.2	+3.5	+0.2	+0.1	+3.5	+1.0	+1.3	+0.1

TABLE 6-15 A9 TEST POINT AND CONNECTOR PIN VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
TP-1	+1.3	
TP-2	−4.7	
TP-3	−3.0	
TP-4	+11.6	
TP-5	+11.6	
TP-6	−0.3	
Connector Pin		
2	0	
3	+12.0	

TABLE 6-15. A9 TEST POINT AND CONNECTOR PIN VOLTAGE CHART (Cont)

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
4	–	
5	+0.2	
6	–	
7	+3.6	
8	–	
9	+1.0	
10	–	
11	–12.0	
12	+12.0	
13	–	
14	–	
15	0	
16	–	
17	–	
18	–	
19	–	
20	–	
21	+0.7	
22	–.3	
23	0	

TABLE 6-16. A9 WAVEFORM CHART

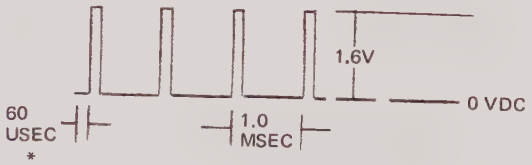
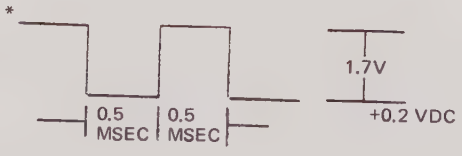
TEST POINT	WAVEFORM OR LEVEL	REMARKS
Pin 5		*Measured from start of Ref. Input – A9 Pin 9
Pin 9		*Ref. Point for other wave form starting times

TABLE 6-16. A9 WAVEFORM CHART (Cont)

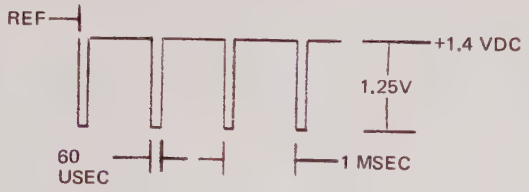
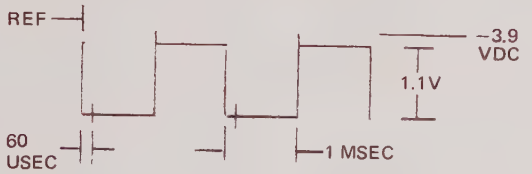
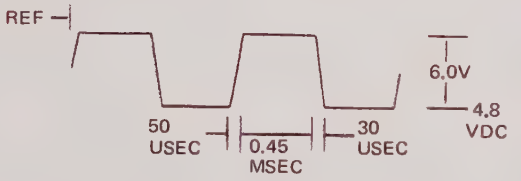
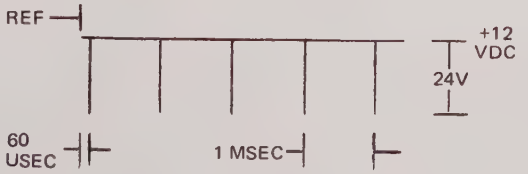
TEST POINT	WAVEFORM OR LEVEL	REMARKS
Pin 22	+2.068 VDC at 20.5 MHz	Changes with Frequency
TP1		
TP2		
TP3		
TP4		
TP5		

TABLE 6-16. A9 WAVEFORM CHART (Cont)

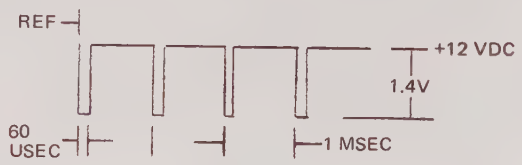
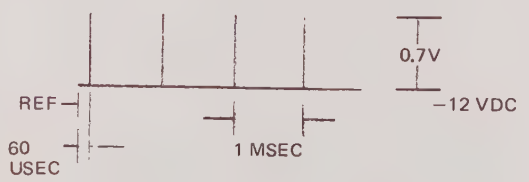
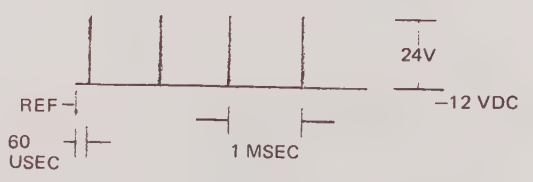
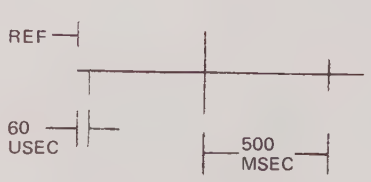
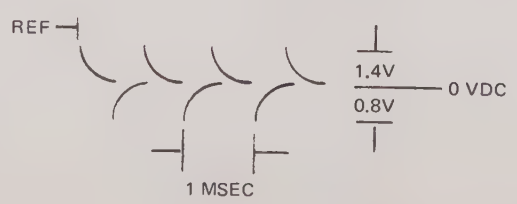
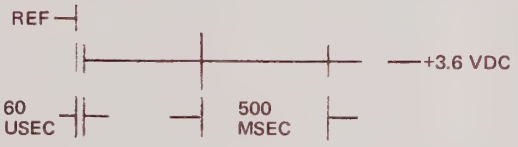
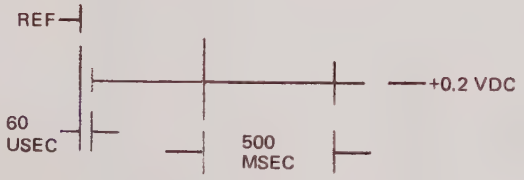
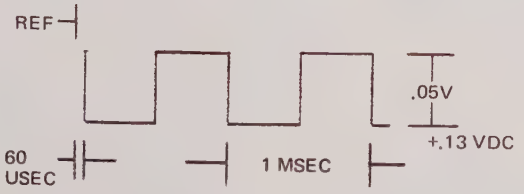
TEST POINT	WAVEFORM OR LEVEL	REMARKS
Q3-C		
Q4-E		
Q10-C		
Q12-C		
Q16-D		
IC1-1		

TABLE 6-16. A9 WAVEFORM CHART (Cont)

TEST POINT	WAVEFORM OR LEVEL	REMARKS
IC1-2, 5		
IC1-7		
IC1-8		
IC1-9		
IC1-10, 14		

PARTS LOCATION GUIDE FOR FIGURE 6-14, ASSEMBLY A9

A9

REF DESIG	LOCATION
C1	H,39
C2	II,22
C3	AA,30
C7	X,33
C8	S,36
C9	T,39
C11	O,10
C12	CC,10
C13	M,11
C14	O,18
C15	S,19
C16	HH,11
C17	K,28
C18	CC,6
C19	M,36
CR1	CC,18
CR2	W,26
CR3	DD,22
CR4	K,7
CR5	G,20
CR6	P,20
CR7	N,13
CR8	T,12
CR9	P,34
IC1	U,8
L1	O,14
Q1	AA,10
Q2	EE,32
Q3	BB,39
Q4	Y,38
Q5	JJ,25
Q6	Y,16
Q7	HH,13
Q8	II,10
Q9	K,20
Q10	M,27
Q11	V,24
Q12	Y,24
Q13	BB,23
Q15	S,32
Q16	O,38
Q17	K,39
Q18	I,35
Q19	Y,4
Q20	R,15
Q21	Q,18
Q22	II,8
Q23	HH,6
Q24	J,30
R1	P,6
R3	O,31
R4	L,10
R5	HH,32
R6	JJ,28
R7	EE,39
R8	FF,37
R9	GG,33
R10	CC,34
R11	AA,14
R12	HH,20
R13	CC,16
R14	X,18
R15	HH,18
R18	I,16
R19	O,26
R20	M,24
R21	Q,26
R22	R,28
R23	S,27
R24	U,22
R25	X,24
R26	BB,26
R27	AA,20
R29	DD,24
R31	J,34
R32	I,24
R35	CC,12
R36	AA,7
R37	W,6
R38	CC,15
R39	O,17
R40	U,16
R41	Q,10
R42	JJ,4
R43	FF,10
R44	FF,5
R45	L,32
R46	M,31
TP1	R,10
TP2	GG,15
TP3	FF,28
TP4	FF,23
TP5	U,28
TP6	I,28

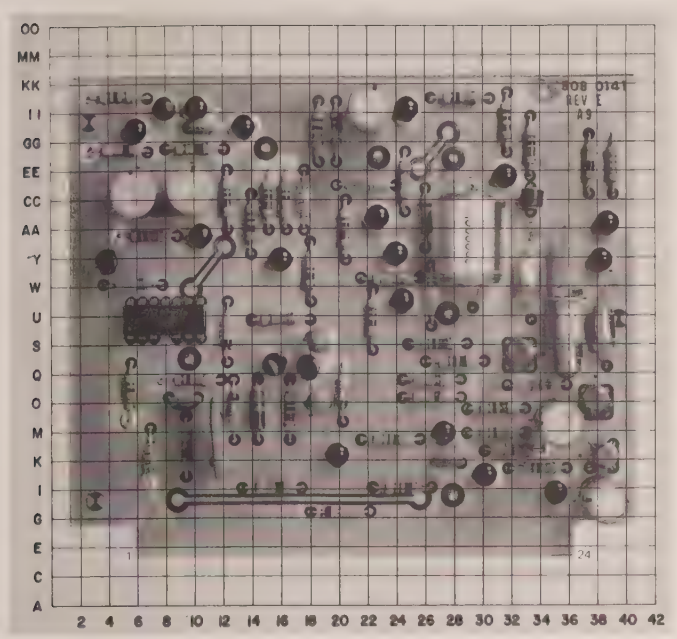


Figure 6-14. Parts Location, Assembly A9 (REV M).

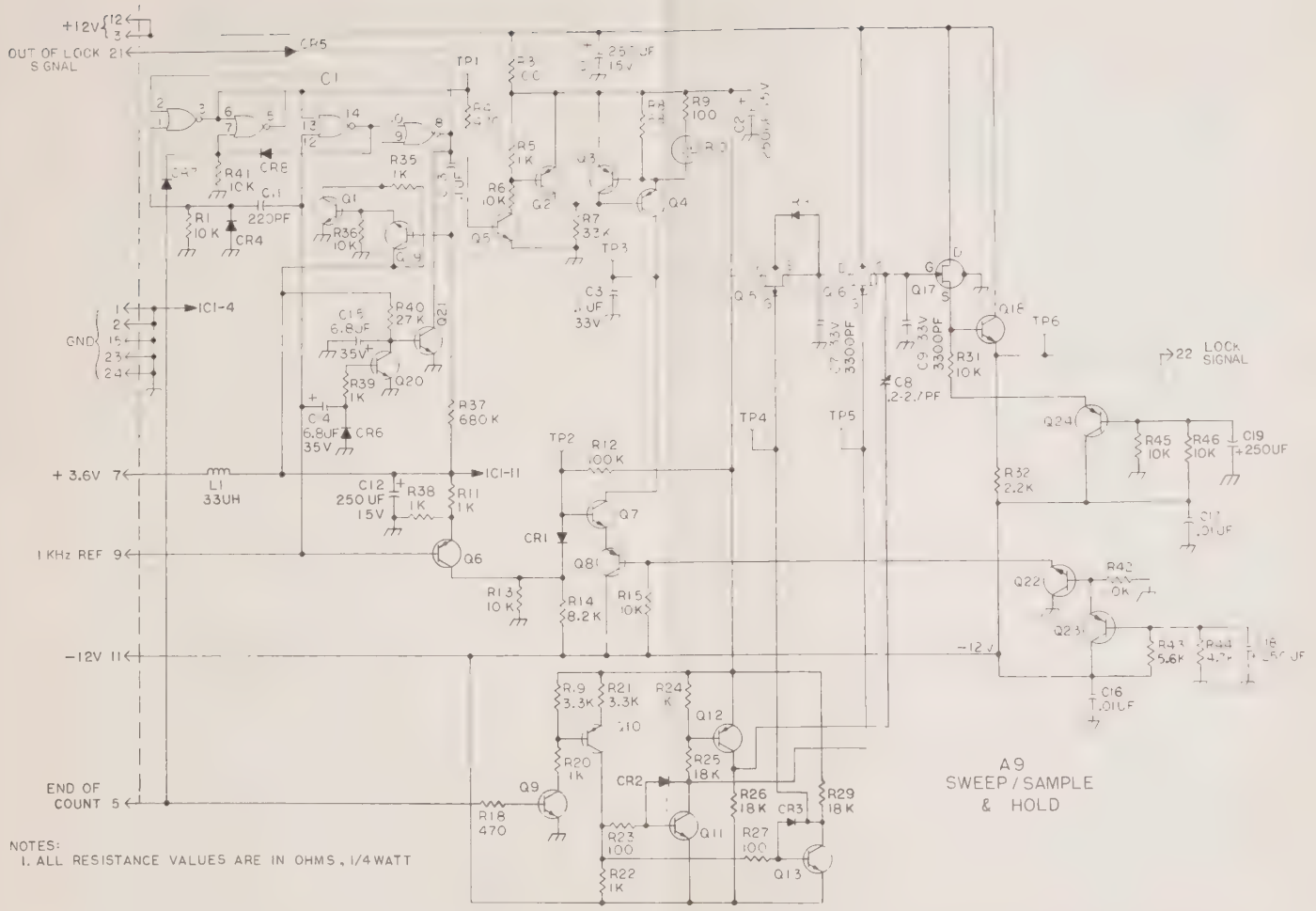


Figure 6-15. Sweep/Sample and Hold PC Board A9, Schematic Diagram

6.12 20 MHZ PLL PC BOARD A10.

6.12.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with 20 MHz PLL PC Board reference designator A10, unless otherwise specified.

The 20 MHz phase locked loop consists of a 20 MHz VCXO and a sampling phase detector, in which the 20 MHz signal from the VCXO is sampled by a signal derived from the 1 MHz frequency standard A21. The output from the phase detector is used to control the frequency of the 20 MHz VCXO so that is is phase locked to the frequency standard. Refer to schematic diagram figure 6-17.

The crystal oscillator utilizes Q2 in a grounded base configuration. The oscillator tank circuit comprises L3, C18, C19 and C46. Positive feedback is applied via L5, CR3 and the crystal Y1 to the emitter circuit. R20 provides some negative feedback to stabilize the oscillator amplitude. As the voltage applied to varactor CR3 via L6 is varied the oscillator frequency changes. The oscillator output is attenuated by R22 and R23 and drives IC3 gate 1-2-3 which operates in a linear mode as a result of the negative feedback through R24. The signal then passes through two squaring gates and appears at IC3, pin 8 as a 20 MHz square wave. This signal is coupled by C44 to low pass filter L7, C42, to attenuate the harmonics of 20 MHz introduced in the amplifying process. Q3 amplifies the signal and T2 matches the collector output impedance to 47 ohms, R29. The 20 MHz waveform is then applied to the diode bridge CR4 through CR7 of the sampling phase detector.

The 1 MHz signal from the frequency standard enters at A10 pin 3 and passes through C31 and R1 to the low pass filter C1, C2, C3 and L1 and is clipped by diodes CR1 and CR2. IC1 gates 1-2-3 and 4-5-6 amplify the signal to produce a square wave input to pins 9 and 12. Gate 12-13-11 inverts the square wave which is delayed by 15 nanoseconds when it reaches pin 10 of IC1. Thus the output at pin 8 of IC1 is a positive pulse about 15 nanoseconds wide at a stable 1 MHz rate. This pulse is amplified in Q1 and coupled through transformer T1 to the diode bridge.

The four diodes conduct for 15 nanoseconds and as they are closely matched, the potential at CR4-CR5 junction is the same as that at CR6-CR7. In this way the 20 MHz signal from T2 passes through the bridge unchanged during the time the bridge is conducting. Thus, the 20 MHz signal is sampled at a 1 MHz rate and the signal pulses are integrated by C9. R13 and C10, and applied to operational amplifier IC2. The amplifier output is filtered by R36 and C37 to control the oscillator frequency via L6 and so completes the phase lock loop.

20 MHz PLL PC Board A10 also supplies a phase-locked 10 MHz signal in the following manner. IC4 is connected to IC3 pin 6. The 20 MHz input is divided by 2 and the resulting phase locked 10 MHz square wave leaves the board at pin 11 for use in the VHF Loop B module, A15.

IC3 gate 12-13-11 is connected to pin 3 to provide a buffered 20 MHz signal to IC5, pins 1 and 13. Gates 12-13-11 and 9-10-8 are connected in series to output on pin 20 of the A10 board. When the RF-808 is operating in the VERNIER mode, $\pm$ 500 Hz or $\pm$ 5 kHz SWEEP modes, IC5

pin 12 is high and the 20 MHz phase locked signal on pin 13 is prevented from reaching the output. At the same time, IC5 pin 9 has a 20 MHz signal from the crystal oscillator on A11. As pin 10 is now logical 0, this signal passes through gate 9-10-8 and appears at the output on pin 20 in place of the 20 MHz phase locked signal.

When the CAL button is depressed, IC5 pin 2 is low and the 20 MHz phase locked signal can reach pin 4. Pin 5 of the same gate receives a 20 MHz signal from A16, which may originate in the 20 MHz crystal oscillator or the 20 MHz LC oscillator, (both on A11) depending on the sweep mode selected. IC5 gate 4-5-6 mixes these 20 MHz signals and the beat signal is passed by low-pass filter R34, R35, C26 and C27 to the output pin 17 of R10. From here the signal goes to A11 where it is processed to operate the front panel meter to indicate the zero beat condition.

6.12.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position prior to removing or replacing modules and printed circuit board assemblies.

a. Remove printed circuit board A10 (paragraph 5.3.9). Extend board A10 from main frame using Extender Board 808-0170. Refer to figure 6-16.

b. Unsolder one end of wire connecting A10TP2 to A10 TP3.

c. Connect a .01 UF capacitor between A10 TP4 and the junction of A10R21 and A10Y1.

d. Connect a frequency counter to pin 11 of A10IC3.

e. Perform initial turn-on procedures (paragraph 3.3).

f. Adjust A10L3 for a reading of 20,000 kHz $\pm$ 5 kHz.

g. This completes the 20 MHz PLL assembly alignment and adjustment procedures. Restore equipment to original condition.

6.12.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend the 20 MHZ PLL PC Board A10 from the RF-808 main frame. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Where conditions are not specified, the RF-808 control settings and mode of operation will not affect the resultant data. Refer to figure 6-16 for test points and component locations and figure 6-17 for the assembly schematic diagram. Prefix all reference designators in the following tables with A10.

TABLE 6-17. A10 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	−6.5	−5.7	0	
Q2	−7.0	−6.4	0	
Q3	−6.4	−5.7	0	

TABLE 6-18. A10 INTEGRATED CIRCUIT VOLTAGE CHART
(Voltages are nominal unless other specified)

REF DESIG	PIN													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC1 IC2 IC3 IC4 IC5	–	–	+8.2	−0.4	−0.4	−12.0	−12.0	–	−11.2	+3.9	+12.0	+9.0	–	–

TABLE 6-19. A10 TEST POINT AND CONNECTOR PIN VOLTAGE CHART

TEST POINT	VOLTS DC (NOMINAL)	REMARKS
TP-1	0	
TP-2	+3.9	
TP-3	+3.9	
Connector Pin		
2	0	
3	0	
4	0	
5	0	
6	0	
7	−5.0	
8	0	
9	0	
10	0	
11	−0.9	
12	0	

TABLE 6-19. A10 TEST POINT AND CONNECTOR PIN VOLTAGE CHART (Cont)

TEST POINT	VOLTS DC (NOMINAL)	REMARKS
13	+12.0	
14	−12.0	
15	0	
16	+3.6	0 volts in CAL mode
17	−1.1	
18	0	
19	-1.2	
20	-1.2	
21	0	
22	0	
23	−2.2	−0.3 volts with SWEEP on.
24	−1.2	

TABLE 6-20. A10 WAVEFORM CHART

TEST POINT	WAVEFORM	REMARKS
IC2-10	+4 volts DC (typical)	Jumper connecting TP-2 and TP-3
IC3-3	20 MHz MECL (logic level)	
IC3-6	20 MHz MECL (logic level)	
IC3-8	20 MHz MECL (logic level)	
IC3-11	20 MHz MECL (logic level)	
IC4-13	10 MHz MECL (logic level)	
IC5-3	20 MHz MECL (logic level)	
IC5-6	20 MHz MECL (logic level)	
IC5-11	20 MHz MECL (logic level)	
Q1-E	1 MHz pulse (+)	300 mV on a DC component of −6.8 volts.
Q1-C	1 MHz pulse (−)	
Q3-B	20 MHz sinewave	550 mV peak-to-peak on a DC component of −5.5 volts.
Q3-C	20 MHz sinewave, 700 mV p-p	

TABLE 6-20. A10 WAVEFORM CHART (Cont)

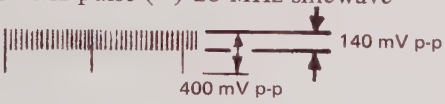
TEST POINT	WAVEFORM	REMARKS
Q3-E	20 MHz sinewave	460 mV peak-to-peak on 0 VDC component of −6.4 volts.
T1-3	1 MHz pulse (+) 20 MHz sinewave	
T1-4	1 MHz pulse (−) 20 MHz sinewave 	
TP-1	20 MHz sinewave, 700 uv p-p	
TP-4	20 MHz sinewave, 1.3V p-p	
TP-5	20 MHz	1.2 volts peak-to-peak on a DC component of +2.5 volts.
IC1-1	1 MHz	1.2 volts peak-to-peak on a DC component of −1.25 volts.
IC1-6	1 MHz MECL squarewave	
IC1-8	1 MHz MECL 15 nanosecond pulse duration	
IC1-11	1 MHz MECL squarewave	
IC2-5	Sinewave, 280 mv p-p	Frequency varies with setting of FREQ VAR control (unlocked)
IC2-10	Sinewave 11V p-p	11 volts peak-to-peak on a DC component of 4.5 volts (unlocked)
Pin 3	Sinewave 4V p-p.	

TABLE 6-20. A10 WAVEFORM CHART (Cont).

TEST POINT	WAVEFORM	REMARKS
Pin 17	See Remarks Column	DC when SWEEP OFF or CAL OFF. 0.5V p-p signal when CAL is on with VERN or MANUAL SWEEP. In VERN, fo is DC to 1 kHz as a function of VERN and CAL setting in MANUAL SWEEP, fo is 500 Hz – 0 – 500 Hz 5 kHz – 0 – 5 kHz 50 kHz – 0 – 50 kHz 500 kHz –0 – 500 kHz In ± 500 Hz, ± 5 kHz, ± 50 kHz, ± 500 kHz ranges respectively, as a function of MANUAL SWEEP setting.
Pin 19	See Remarks Column	DC when SWEEP OFF. MECL LEVEL in VERN. fo 20.000 MHz to 20.001 MHz as a function of VERN and CAL setting (0.8V p-p) MECL LEVEL in MAN SWEEP 19.999500 MHz – 0 – 20.000500 MHz or 19.995000 MHz – 0 – 20.005000 MHz in ± 500 Hz and ± 5 kHz SWEEP RANGES respectively, as a function of MANUAL SWEEP setting ((0.8V p-p)
Pin 20	See Remarks Column	20.000000 MHz Phase Locked when SWEEP OFF (0.8V p-p) MECL levels. Same as pin 19 in VERN and MANUAL SWEEP modes.
Pin 24	See Remarks Column	20.000000 MHz Phase Locked when SWEEP OFF (0.8V p-p) MECL levels. Same as pin 19 in VERN, and MANUAL SWEEP ranges ± 50 kHz and ± 500 kHz.

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PARTS LOCATION GUIDE FOR FIGURE 6-16, ASSEMBLY A10

A10

REF DESIG	LOCATION
C1	J,6
C2	K,3
C3	M,5
C4	M,6
C5	W,5
C6	O,10
C7	W,9
C8	BB,7
C9	EE,6
C10	V,15
C11	Q,24
C13	Z,19
C14	U,22
C15	FF,33
C16	CC,36
C17	Q,33
C18	FF,26
C19	CC,32
C20	AA,12
C21	II,9
C22	HH,5
C23	K,36
C24	I,23
C25	EE,34
C26	N,25
C27	K,25
C28	U,12
C29	V,2
C30	II,22
C31	I,8
C32	S,15
C33	Y,22
C34	K,11
C35	N,14
C36	P,13
C37	K,18
C38	L,15
C39	K,22
C40	N,17
C41	N,19
C42	JJ,11
C43	LL,7
C44	II,15
C45	EE,18
C46	EE,28
C47	V,26
C48	KK,16
C49	J,26
CR1	L,9
CR2	L,8
CR3	Y,32
CR4	DD,2
CR5	DD,5
CR6	DD,4
CR7	DD,3
IC1	S,5
IC2	V,18
IC3	II,19
IC4	DD,16
IC5	N,30
L1	L,2
L2	T,10
L3	HH,30
L4	U,34
L5	AA,32
L6	Z,28
L7	II,13
L8	CC,13
L9	L,35
L10	K,13
L11	J,17
L12	K,21
L13	U,6
Q1	Z,6
Q2	GG,34
Q3	II,6
R1	H,5
R2	O,6
R3	P,4
R4	X,4
R5	X,7
R6	BB,4
R7	AA,7
R8	AA,9
R9	DD,9
R10	P,20
R11	Q,20
R12	O,18
R13	X,13
R15	S,20
R16	Z,21
R17	EE,32
R18	HH,35
R19	GG,37
R20	BB,35
R21	W,34
R22	FF,27
R23	II,27
R24	KK,20
R25	KK,4
R26	KK,9
R27	HH,7
R28	HH,9
R29	GG,4
R30	L,33
R31	L,24
R32	M,27
R33	J,30
R34	O,28
R35	O,26
R36	Z,26
R37	II,12
R38	H,29
T1	Z,3
T2	II,2
Y1	U,30
Test Points	
TP1	HH,23
TP2	BB,25
TP3	Z,23
TP4	BB,30
TP5	W,29

NOTES FOR FIGURE 6-17:

1. All resistance values are in ohms ± 5%, 1/4 watt, unless otherwise specified.
2. All capacitance values are in microfarads, unless otherwise specified.

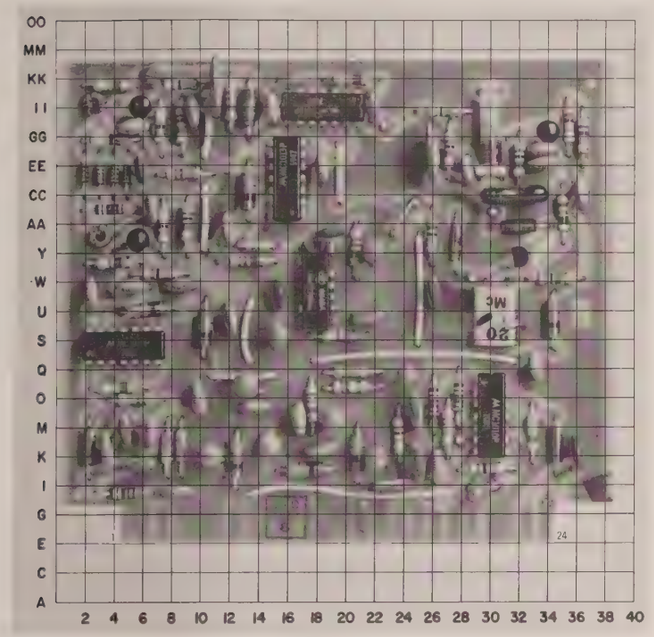


Figure 6-16. Parts Location, Assembly A10 (REV E)

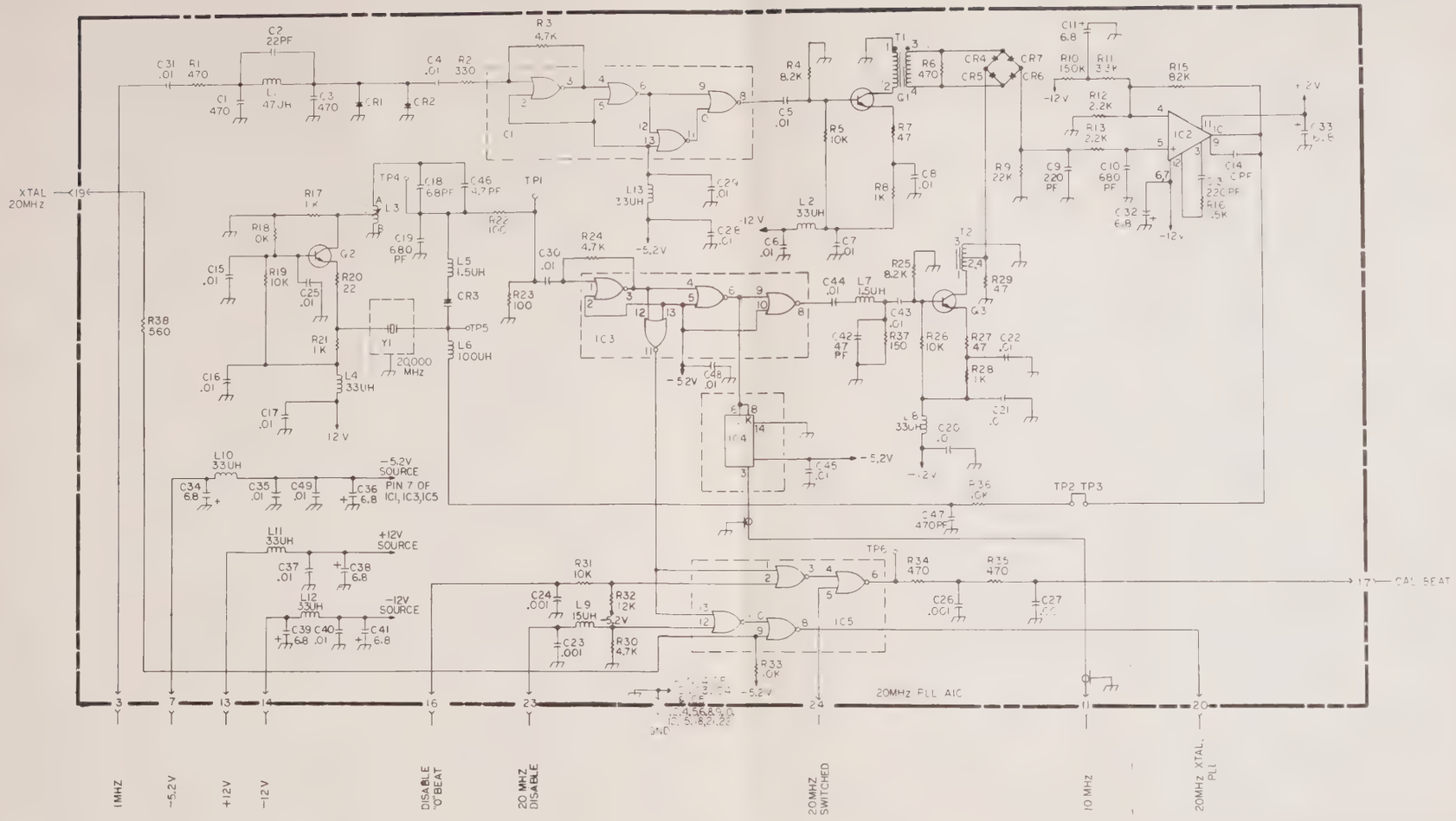


Figure 6-17. 20 MHz PLL PC Board A10, Schematic Diagram.

6.13 20 MHZ SWEEP PC BOARD A11.

6.13.1 Circuit Description.

NOTE

Prefix all reference designators in paragraphs 6.13.1 and 6.13.2 with 20 MHz Sweep PC Board reference designator A11, unless otherwise specified.

The 20 MHz Sweep PC Board A11 contains a voltage controlled crystal oscillator (VCXO), used in the VERNIER, ± 500 Hz and ± 5 kHz SWEEP modes; a voltage controlled LC oscillator (VCO) used in the ± 50 kHz and ± 500 kHz SWEEP modes and in the FM mode up to the maximum deviation of ± 375 kHz; and a calibration circuit used to indicate a beat between the 20 MHz phase locked signal and the 20 MHz VCXO every 100 Hz when in VERNIER. The calibration circuit is also used to set the zero index of the AUTO/MANUAL SWEEP control when in SWEEP modes up to ± 500 kHz.

The two oscillators are mounted on a metal plate which is heated to maintain the temperature of the circuit close to 75° C as the ambient temperature varies over the range from 0 to 50° C. In this way the temperature stability of the oscillators is improved.

Refer to schematic diagram figure 6-20. The VCXO on sub-assembly A2 uses A2Q1 in a grounded-base connection. A2Y1 is a 20 MHz series resonant crystal and is located in the positive feedback loop from the collector tuned circuit to the emitter. A2R4 provides some negative feedback for amplitude control. The tuned circuit consists of A2T1, A2C6, -7, -8. The feedback signal is taken from a tap on A2T1 through A2C4 to a series resonant circuit A2C5, A2L2 and A2CR2 and then through A2Y1. A2L3 (in parallel with the crystal) compensates for the capacity of the crystal holder and improves the oscillator linearity over the ± 5 kHz range. On subassembly A1, resistors A1R3 through A1R6 set the bias level at the anode of varactor A2CR2 and A1R7, A1R8 and A1R14 set the bias on the cathode. A1R6 and A1R7 are adjusted so that a ± 6 volt change on A3, pin 15 causes a ± 5 kHz shift in the oscillator frequency. The output of the oscillator is fed through A3C1 to series connected gates IC1 (1-2-3) and (4-5-6). The squared and amplified signal leaves at pin 6 of A3. These gates are enabled by a low on A3, pin 4. This same condition prevents diode A2CR1 from conducting. When A3 pin 4 goes high A2CR1 passes current supplied through A2R1, and this effectively connects the collector of A2Q1 to ground and oscillation is prevented. Thus with A3 pin 4 low, the crystal oscillator is enabled.

The LC oscillator uses A2Q2 in a grounded gate connection. The output tuned circuit consists of A2T2, A2C14, A2C15, A2C16, A2C19 and A2CR5. Positive feedback is taken from tap 3 of A2T2 through A2C12 to the emitter circuit. A2R8 provides some negative feedback for amplitude stability. A2CR4 limits the amplitude of the oscillator output. The oscillator output is buffered by source follower A2Q3 for load isolation. The signal is then amplified and squared in A3IC1 gates 9-10-8 and 12-13-11 and leaves the board at pin 5. These gates are enabled by a low on A3IC1 pins 10 and 12, provided by a low on A3 pin 10. A low here also holds A2CR3 off and the LC oscillator functions normally. When pin 10 goes high A2CR3 conducts, shorts the feedback line to ground and oscillation is prevented. The oscillator is also enabled by a high logic level on A3 pin 19 when the RF-808 is in the FM mode.

The frequency control line for the LC oscillator enters at pin 17 on A3. The voltage varies the bias on A2CR5 and so controls the oscillator frequency. Resistors A2R12, A1R12 and A1R13 fix the voltage on the anode of A2CR5. Trimmer resistors A1R17, -R22, -R27, -R32 and -R13 together with the associated resistors on A1 are used to set the center frequency of the LC oscillator and linearize the frequency as a function of the control voltage. Diodes A2CR6, A2CR8 and A2CR7 turn on progressively as the control voltage goes more negative.

The calibrate circuitry is located on sub-assembly A1. When the VERN and CAL buttons are depressed, a 1 kHz signal derived from the frequency standard enters the board at pin 22. It is divided by 10 in A3IC2 and A3IC3. As the 100 Hz signal enters A1 at pin 11 A1C14 and A1R38 differentiate the waveform causing A1Q4 to turn off for a short time at the 100 Hz rate. This causes the collector of A1Q4 to rise and turns on A1Q3 for this interval. The beat frequency signal between the 20 MHz PLL and the 20 MHz VCXO enters A1 at pin 20 and is amplified by A1Q1 and buffered by A1Q2 to provided a low source impedance. When A1Q3 is turned on by the sampling pulse, the signal on the emitter of A1Q2 charges A1C15. When A1Q3 turns off again the voltage is held by A1C15 and buffered at a high impedance by A1Q5 and A1Q6. The signal at the emitter of A1Q5 is coupled to low pass filter A1R43 and A1C16 and drives the OUTPUT meter via A1C17 and A1R44. The combination of the beat frequency signal entering A1 pin 20, and the 100 Hz signal into A1 pin 11 will thus provide beats at the "zero" point and at every 100 Hz point of the VERNIER control.

When the MANUAL SWEEP ranges up to $\pm$ 500 kHz are used, the 1 kHz input to pin 22 is disabled. The signal entering at the base of A1Q1 is then the beat note between the 20 MHz PLL signal and that from either the 20 MHz VCXO or the 20 MHz VCO. When these frequencies are within approximately 5.0 Hz the beat signal passes through the low pass filter A1R40 and A1C16 and provides a pulsating indication on the OUTPUT meter. This calibrates the MANUAL SWEEP control at the center frequency point, i.e., the frequency selected by the front panel frequency control switches.

6.13.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position prior to removing or replacing printed circuit board A11.

a. Remove printed circuit board A11 (paragraph 5.3.9). Extend board A11 from main frame using Extender Board 808-0170.

b. Perform initial turn-on procedures (paragraph 3.3).

NOTE

Before making any adjustments to the 20 MHz Sweep Oscillator PC Board, allow two hours for ovens to stabilize the temperature of the critical circuitry. Refer to figures 6-18 and 6-19.

c. Depress the MAN SWEEP and $\pm$ 5 kHz RANGE SELECT pushbuttons.

d. Connect an oscilloscope with low capacity probe to A2E12 and adjust C8 for a maximum 20 MHz output.

e. Remove probe from E12 and ground A2E10. Adjust a regulated DC power supply for +10.000 volts ± .001 and connect to A2E13. Connect a frequency counter to A3 pin 6, and adjust A2C5 for a reading of 20,000.000 kHz ± 1 Hz .

f. Repeat steps d and e until no further adjustment is necessary. Disconnect the power supply from A2E13

g. Connect a digital voltmeter to pin 15 of A11. Rotate the MANUAL SWEEP control until this voltage is 0.000 ± 0.001 volts. Connect a frequency counter to pin 6 of A11 and adjust A1R6 for a reading of 20,000.000 kHz ± 1 Hz.

h. Rotate the MANUAL SWEEP control until the voltage on pin 15 of A11 is 6.000 ± 0.001 volts and adjust A1R7 until the counter reads 20,005.000 kHz ± 1 Hz.

i. Repeat steps g and h until no further adjustments are necessary.

j. Place RF-808 POWER ON/OFF switch to OFF position. Unsolder extender board lead to A3, pin 17 mating connector.

k. Energize the RF-808 and depress the ± 500 kHz RANGE SELECT pushbutton.

l. Ground TP11 on A1. Connect a regulated DC power supply adjusted for +12.500 ± 0.001 volts to A11 pin 7.

m. Connect a frequency counter to A3 pin 5 and adjust A2C16 for a counter reading of 20.500 kHz ± 1 kHz.

n. Disconnect the supply from A3 pin 17 and reconnect the lead to A3 pin 17. Remove the ground from TP11.

o. Monitor the voltage on the output of the SWEEP BUFFER amplifier, A3 pin 15. Set A3R17 to maximum resistance. Connect a frequency meter to A3 pin 5.

p. Rotate the MANUAL SWEEP control to give the following voltage readings and adjust the corresponding resistor to produce the indicated frequency

Voltage	Resistor	Frequency
+6.000 ± .001V	A11A3R13	20,500 kHz ± 20 kHz
+0.600 ± .001V	A11A3 R22	20,050 kHz ± 1 kHz
0.000 ± .001V	A11A3R32	20,000 kHz ± 1 kHz
−0.600 ± .001V	A11A3R27	19,950 kHz ± 1 kHz

q. Repeat the sequence in step g. above until no further adjustments are necessary. With the voltage set to −6.000 ± .001 volts, the counter should read 19,500 kHz ± 20 kHz.

6.13.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend 20 MHz Sweep Oscillator PC Board A11 from the RF-808 main frame. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Where conditions are not specified, the RF-808 control settings and mode of operation will not effect the resultant data. Refer to figure for test points and component locations and figure for the assembly schematic diagram.

TABLE 6-21. A11 TRANSISTOR VOLTAGE CHART (Sub-assembly A11A1).
(Prefix all reference designators with A11A1)

REF DESIG	VOLTS DC NOMINAL			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	−0.4	−1.0	−7.7	
Q2	+6.7	+7.3	+12.0	
Q3 FET	+6.7 (Source)	+4.7 (Drain)	0 ((Gate)	
Q4	0	+0.6	+4.7	
Q5	+4.5	+4.7	+12.0	
Q6	+12.0	+12.0	+4.5	

TABLE 6-22. A11 TRANSISTOR VOLTAGE CHART (Sub-assembly A11A2).
(Prefix all reference designators with A11A2)

REF DESIG	VOLTS DC NOMINAL			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	−6.5	−5.7	0	
Q2 FET	+1.1 (Source)	+12.0 (Drain)	0 (Gate)	
Q3 FET	+1.2 (Source)	+8.5 (Drain)	0 (Gate)	

TABLE 6-23. A11 TRANSISTOR VOLTAGE CHART (Subassembly A11A3)
(Prefix all reference designators with A11A3)

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	−5.2	−7.8	+0.6	
Q1	−5.2	−4.6	−5.2	FM mode
Q1	−5.2	−7.8	−5.2	± 50 kHz SWEEP, ± 500 Hz SWEEP, MANUAL SWEEP, AUTOMATIC SWEEP modes.

TABLE 6-24. A11 CONNECTOR PIN VOLTAGE CHART (Sub-assembly A11A1).
(Prefix all reference designators with A11A1)

CONNECTOR PIN	VOLTS DC (NOMINAL)	REMARKS
2	−5.3	
3	−1.0	
4	0	
5	−1.1	
6	−1.1	
7	−1.6	
8	−4.5	
8	+3.0 to +4.0	VERNIER mode
8	+2.7 to +3.6	± 500 Hz SWEEP mode
8	−1.0 to +7.8	± 5 kHz SWEEP mode
9	−10.4	
9	0 to +1.2	VERNIER mode
9	−0.6 to +0.6	± 500 Hz SWEEP mode
9	−6.0 to +6.0	± 5 kHz SWEEP mode
10	0	
11	+0.2	
11	+1.6	VERN and CAL modes
12	−0.1	
13	+12.0	
14	0	
15	+0.6	
15	−5.0	FM, ± 50 kHz SWEEP, ± 500 kHz SWEEP modes
16	−12.0	
17	+0.6	
17	−5.0	FM, ± 50 kHz SWEEP, ± 500 kHz SWEEP modes
18	−12.0	
19	−6.8	
20	−1.0	

TABLE 6-24. A11 CONNECTOR PIN VOLTAGE CHART (Sub-assembly A11A1) [Cont].
(Prefix all reference designators with A11A1)

CONNECTOR PIN	VOLTS DC (NOMINAL)	REMARKS
21	+12.0	
22	+0.7	
22	−5.2	VERNIER, ± 500 Hz SWEEP ± 5 kHz SWEEP modes
23	+0.8	
23	−5.2	VERNIER, ± 500 Hz SWEEP, ± 5 kHz SWEEP modes.

TABLE 6-25. A11 CONNECTOR PIN VOLTAGE CHART (Sub-assembly A11A3)
(Prefix all reference designators with A11A3)

CONNECTOR PIN	VOLTS DC (NOMINAL)	REMARKS
2	0	
3	0	
4	+0.8	
4	−5.2	VERN, ± 500 Hz SWEEP, ± 5 kHz SWEEP modes
5	−1.7	
6	−1.7	
7	+3.6	
8	−1.0	
9	0	
10	+0.6	
10	−5.2	FM, ± 50 kHz SWEEP, ± 500 kHz SWEEP, MANUAL SWEEP, AUTOMATIC SWEEP modes
11	−12.0	
12	+12.0	
13	0	
14	−0.1	
15	−10.4	
15	0 to +1.2	VERN mode, function of vernier setting
16	0	
17	−1.6	
18	−5.2	
19	−4.9	
19	+3.6	FM mode
20	+23.8	
21	0	
22	+0.2	
23	0	

TABLE 6-26. A11 WAVEFORM CHART

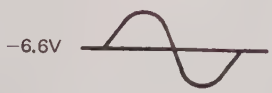
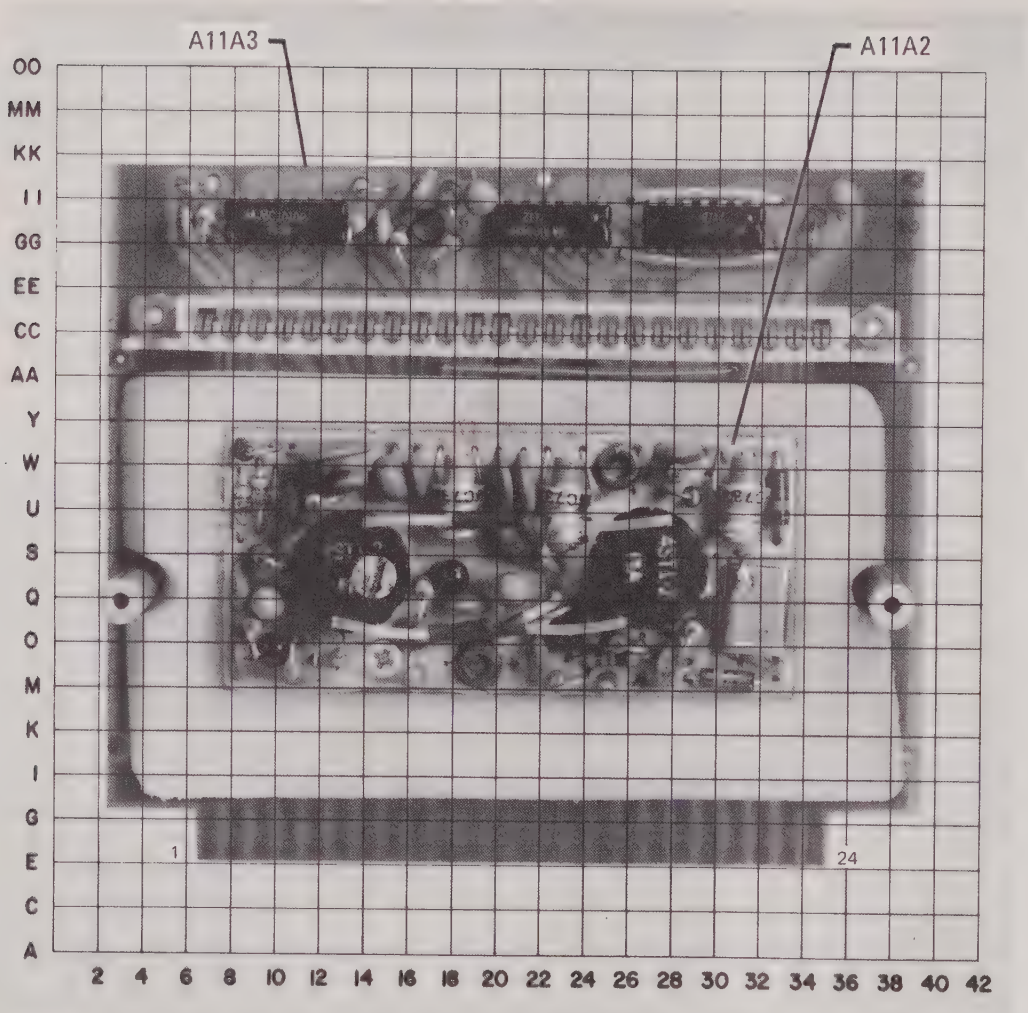
TEST POINT	WAVEFORM	REMARKS
A11A1 Pin 12		Off zero beat the DC LEVEL goes plus or minus
Pin 20		
Q1-C		
Q2-E		
Q3-Gate		
Q3-Drain		Off zero beat this waveform is a square wave
Q5-E		
A11A2 Q1-C		

TABLE 6-26. A11 WAVEFORM CHART (Cont)

TEST POINT	WAVEFORM	REMARKS
Q2-Source		
Q3-Source		
A11A3 IC1-8		
IC1-9		
IC1-11		
IC2-1		
IC2-2		
IC2-9		
IC2-13		

TABLE 6-26. A11 WAVEFORM CHART (Cont)

TEST POINT	WAVEFORM	REMARKS
IC3-9		
IC3-14		
Pin 5	See Remarks Column	20 MHz in FM frequency modulated or DEVIATION selected 1.1V p-p. 20 MHz ± 50 and ± 500 kHz in MANUAL SWEEP as a function of MANUAL SWEEP setting. SWEEPS in AUTO ± 50 and ± 500 kHz ranges only 1.1V p-p
Pin 14	See Remarks Column	0 to 10 Hz Beat Note. DC GRD to −0.1V in VERN and 4 lowest ranges of MANUAL SWEEP. Varies as a function of VERNIER and MANUAL SWEEP setting. At 000 Hz VERNIER, Beat Note is +0.1V to −0.3V.
Pin 22		1 kHz square wave with VERN and CAL buttons depressed.



A11A2

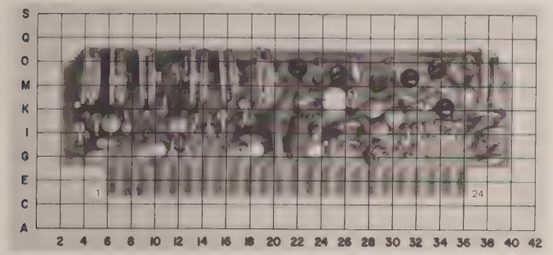
REF DESIG	LOCATION
B1	S,26
B2	S,14
C1	T,21
C2	P,24
C3	N,28
C4	X,28
C5	V,31
C6	W,20
C7	W,21
C8	V,23
C9	Q,10
C10	R,8
C11	Q,18
C12	O,16
C13	N,22
C14	V,15
C15	W,17
C16	V,18
C17	N,8
C18	V,13
C19	X,12
C20	U,11
C21	R,21
CR1	S,22
CR2	Q,30
CR3	O,12
CR4	N,13
CR5	W,12
CR5	U,8
CR7	V,9
CR8	U,10
L1	V,29
L2	V,33
L3	N,31
L4	S,9
L5	X,9
Q1	P,23
Q2	R,18
Q3	O,10
R1	P,22
R2	M,23
R3	N,25
R4	O,26
R5	M,25
R6	P,29
R7	W,28
R8	Q,16
R9	M,16
R10	P,9
R11	N,11
R12	U,12
T1	W,26
T2	N,19
Y1	Q,32

Figure 6-18. Parts Location, Assemblies A11A2, -A3 (REV E).

See Figure 6-18

A11A3

REF DESIG	LOCATION
C1	HH,6
C2	HH,15
C3	II,36
C4	II,16
C5	II,19
IC1	HH,10
IC2	HH,30
IC3	HH,22
L1	HH,34
L2	II,18
Q1	HH,17
R1	JJ,7
R2	HH,7
R3	HH,13
R4	II,14
R5	GG,18
R6	GG,16



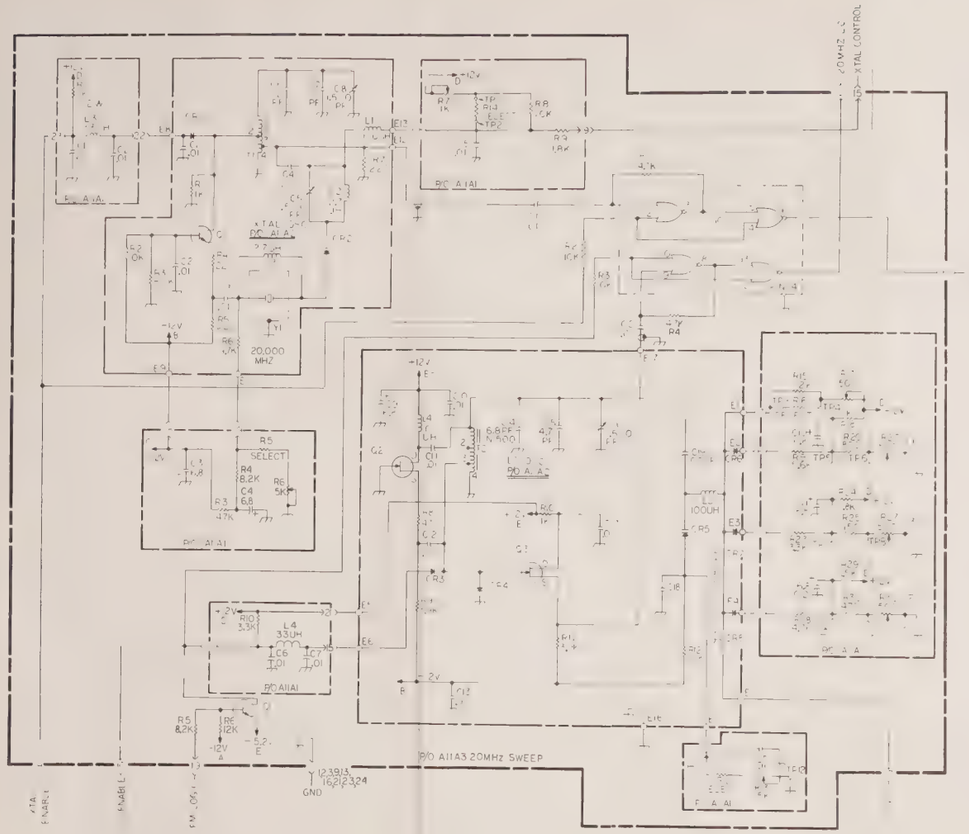
A11A1

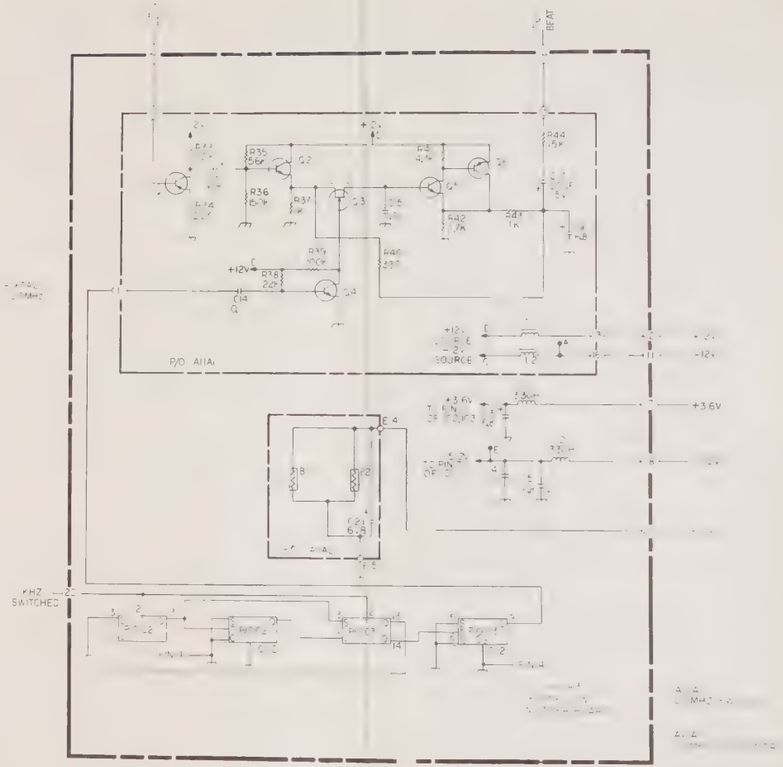
REF DESIG	LOCATION
C1	G,38
C2	I,39
C3	I,29
C4	J,30
C5	I,18
C6	J,26
C7	H,25
C8	G,5
C10	J,12
C11	G,9
C12	J,6
C13	M,36
C14	I,20
C15	N,27
C16	K,28
C17	L,25
L1	I,22
L2	G,29
L3	H,38
L4	H,27
Q1	K,34
Q2	O,34
Q3	N,31
Q4	N,29
Q5	N,25
Q6	Q,22
R1	K,39
R3	H,31
R4	J,32
R5	G,31
R6	N,38
R7	N,19
R8	J,18
R9	H,17
R10	J,35
R12	I,4
R13	N,5
R15	I,15
R17	N,16
R18	M,12
R19	G,13
R20	J,13
R22	N,14
R23	G,11
R24	O,12
R25	K,11
R27	N,9
R28	H,5
R29	I,8
R30	J,5
R32	N,7
R33	I,35
R34	K,33
R35	O,35
R36	O,36
R37	M,34
R38	L,22
R39	O,30
R40	L,31
R41	N,24
R42	M,23
R43	M,26
R44	I,24
R45	

Test Points

TP1	L,17
TP2	J,17
TP3	I,16
TP4	K,16
TP5	M,12
TP6	K,12
TP7	I,9
TP8	K,9
TP9	I,4
TP10	J,4
TP11	K,3
TP12	G,3

Figure 6-19. Parts Location, Assembly A11A1 (REV H)





NOTES:
1. UNLESS OTHERWISE SPECIFIED
1.1 ALL RESISTANCE VALUES ARE IN OHMS ±5%, 1/4 WATT
1.2 ALL CAPACITANCE VALUES ARE IN MICROFARADS

Figure 6-20. 20 MHz Sweep PC Board A11, Schematic Diagram.

6.14 ATTENUATOR ASSEMBLY A12.

6.14.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Attenuator Assembly reference designator A12, unless otherwise specified.

Attenuator Assembly A12 contains four resistive attenuator pads which are selected in combination to provide attenuation from 0 to 150 dB in 10 dB steps. It also contains the associated logic decoders and driver stages.

The rf signal from the Output Amplifier Assembly A19 passes through the attenuator before appearing at the RF OUTPUT connector. The pads are switched in or out of circuit by means of relays controlled by the attenuator buttons on the front panel or by external signals when the REMOTE mode is selected.

Refer to schematic diagram figure 6-3. When Attenuator Assembly connector pin 3 (10 dB line) goes high, pin 7 of A1IC1 goes low Q1 on A1 is then turned off and its emitter, connected to the base of Q1 on A2, is low. Q1 on A2 is then turned off and relay A2K1 is de-energized. Switches A2S1 and A2S2 are then connected together and the 10 dB pad comprising A2R1, A2R2 and A2R3 is bypassed. In a similar way, the 20, 40 and 80 dB pads are controlled by the logic levels on pins 5, 7 and 9 respectively. In the REMOTE mode the pads are selected by signals on A1 pins 4, 6, 8 and 10 from the REMOTE connector J1. When the +30 DBM attenuator button A4S33 is depressed pin 11 goes high and turns on Q6. This holds pins 3, 5, 6 and 7 low and all the relays are de-energized. The attenuator then operates straight through. Note that as a safety feature the +30 DBM ON/OFF switch S42 must also be in the ON position for the attenuator to operate straight through. Q5 is a lamp driver for DS2, the READY lamp, on the front panel. Pin 15 receives the out of lock signal from Sweep/Sample and Hold PC Board A9. When this is high A1Q5 is on and the READY lamp is illuminated.

6.14.2 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

Depress RF-808 +20 DBM button for all tests on Attenuator Assembly A12, Refer to figure 6-21 for test points and component locations and figure 6-3 for assembly schematic diagram.

TABLE 6-27. A12 TRANSISTOR VOLTAGE CHART

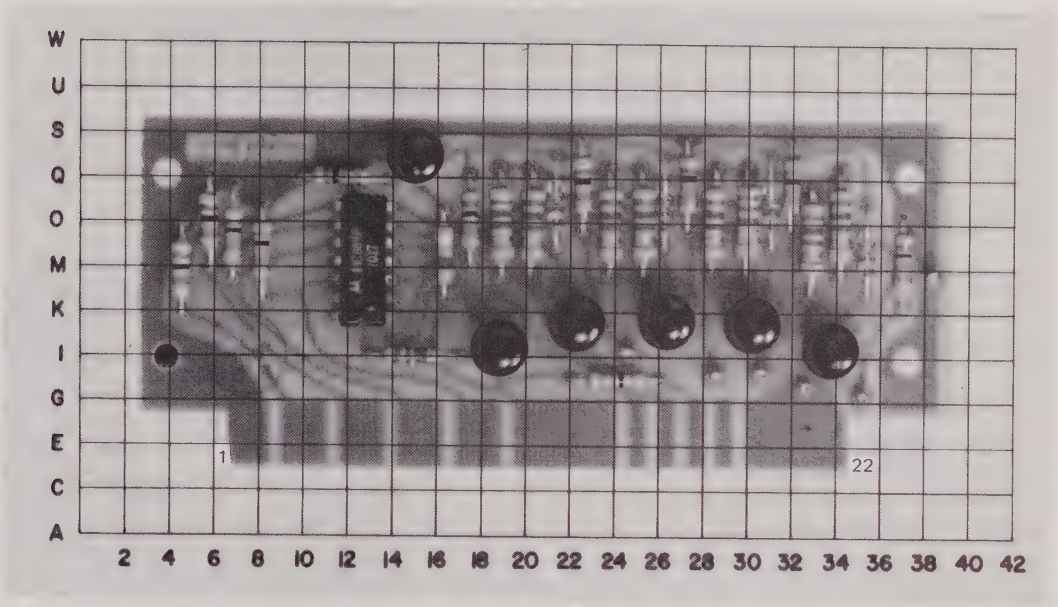
REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	0	+0.2	+7.9	+20 DBM button depressed
Q2	0	+0.2	+7.9	
Q3	0	+0.2	+7.9	
Q4	0	+0.2	+7.9	
Q5	0	+0.7	+0.1	
Q6	0	0	+3.5	

TABLE 6-28. A12 INTEGRATED CIRCUIT DC VOLTAGE CHART
(Voltages are nominal unless otherwise specified)

REF DESIG	PIN													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC1	+3.6	+3.6	+0.2	0	+0.2	+0.2	+0.2	+3.6	+3.6	+3.6	+3.6	+3.6	0	0

TABLE 6-29. A12 CONNECTOR PIN VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
Connector Pin		+20 DBM button depressed
2	GND	
3	+3.6	
4	+3.6	
5	+3.6	
6	+3.6	
7	+3.6	
8	+3.6	
9	+3.6	
10	+3.6	
11	0	
12	0	
13	0	
14	0	
15	+0.7	
16	+3.6	
17	+1.7	
18	–	
19	+7.9	
20	+7.9	
21	–	
22	–	
23	Not applicable	



A12A1

REF DESIG	LOCATION
CR1	N,35
CR2	O,31
CR3	P,26
CR4	P,21
IC1	M,12
Q1	I,34
Q2	K,30
Q3	K,26
Q4	K,22
Q5	I,19
Q6	R,15
R1	O,17
R2	M,4
R3	O,6
R4	O,7
R5	N,8
R6	O,34
R7	M,37
R8	O,30
R9	Q,32
R10	O,25
R11	Q,27
R12	O,20
R13	Q,23
R14	H,24
R15	I,15
R16	Q,12
R17	N,16
R18	O,19
R19	O,24
R20	O,28
R21	O,33

Wire Connections	
E1	G,35
E2	H,31
E3	H,28
E4	I,24
E5	M,38
E6	G,32

Figure 6-21. Parts Location, Assembly A12A1 (REV D).

6.15 POWER SUPPLY REGULATOR PC BOARD A13.

6.15.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Power Supply Regulator PC Board reference designator A13, unless otherwise noted.

Power Supply Regulator PC Board A13 receives unregulated DC voltages at nominal levels of +28, +15, +6.3, −15 and −8 volts. These are used to provide regulated voltages of +24, +12, +3.6, −12 and −5.2 volts respectively, to power the circuits used in the RF-808 Signal Generator.

Refer to schematic diagram, figure 6-3. When the unit is plugged in to the line outlet (regardless of the position of the front panel power switch), +28V appears on regulator board connector pin 15. This powers operational amplifier IC3. If the Power switch is OFF, the anode of VR1 is returned to ground potential via the −15V rectifier bridge and secondary winding of T1 located on the main frame. The reference voltage at the wiper of R29 is attenuated by R29, CR3, R27 and the total resistance to ground from the junction of R27 and R36 etc. R29 is adjusted so that the voltage at pin 5 of IC3 is close to +7.15 VDC. The output of IC3 drives the series connected emitter followers Q5, Q6 and Q3, the latter mounted on the main frame. VR2 is a level shifter to hold the output voltage of IC3 at a level which will ensure correct operation at low line voltages. The voltage at the emitter of Q3 is attenuated by R24, R25 and R26 and fed back to the inverting input, pin 4 of IC3. The regulator operates to produce a voltage at A13 pin 12, such that the voltage appearing at IC3 pin 4 is equal to the reference voltage on pin 5 of IC3. R25 is used to set the voltage on A13 pin 12 to +24 volts. C6, C9, C17 and R23 shape the frequency response of IC3 and C20 suppresses the noise generated by VR2.

When the POWER switch on the front panel is in the ON position, the other unregulated voltages are also present. When the +15 volts appears, IC1 is powered via CR1 and a nominal +7.15 volt reference voltage is available at IC1, pin 4. When the −15 volts appears, Q3 is turned on and this turns on Q2, which connects the anode of CR2 to the +24 volt line. CR1 becomes back biased and IC1 is now powered by the +24 volt regulated line. With the −15 volts present the wiper of R29 goes to approximately −7 volts. The cathode of CR3 is at the potential of the reference, nominally +7.15 volts, and thus CR3 is back biased. Thus the reference source for IC3 is switched from VR1 to the more stable reference provided by IC1.

The voltage at pin 4 of IC4 is determined by the reference voltage, the −5.2V and R33 through R36. The −5.2V regulator operates to hold pin 4 of IC4 at the same potential as pin 5, namely ground. The output of IC4 drives inverter Q7, which drives emitter follower Q8. This, in turn drives the series pass transistor Q4 mounted on the main frame. R34 is used to set the voltage on pin 6 to −5.2 volts.

The −12 volt regulator operates in a similar manner to the −5.2 volt regulator with R42 providing the adjustment for the output voltage. Capacitor C15 reduces the noise from the reference supply. R41 and R43 are selected during manufacture to provide the correct range of adjustment for R42.

The operation of the +12 volt regulator is similar to that of the +24 volt regulator. C7 reduces the noise on the reference input to IC2 pin 5.

The operational amplifier used in the +3.6 volt regulator is part of IC1. The +7.15 volt reference is attenuated by R7, R8, and R9 to provide a +3.6 volt reference to the non-inverting input at IC1 pin 3. The regulated +3.6 volts is applied to pin 2 of IC1 via R6. The regulator loop maintains the voltage on IC1 pin 2 equal to that on pin 3, namely +3.6 volts. The output of the operational amplifier in IC1 drives three series connected emitter followers, the first of which is part of IC1 and the last is Q1 mounted on the main frame heat sink. R8 is used to set the output to +3.6 volts and R3 reduces the dissipation in the transistor in IC1 by operating it from the +15 volt supply.

The −12 volt supply needs a minimum load of approximately 60 milliamperes, the −5.2 volt supply a minimum of 50 milliamperes to prevent oscillation in the regulator circuits.

It should be noted that only the +24 volt regulator will operate alone. The other regulators are interdependent by virtue of the voltage requirements of their operational amplifiers.

6.15.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position and power cord is disconnected from power source prior to removing printed circuit board A13 from main frame.

a. Remove main frame top cover (paragraph 5.3.2). Extend A13 from main frame using Extender Board 808-0170.

b. Connect RF-808 power cord to power source. Connect a digital voltmeter (DVM) to A13 connector pin 12, adjust A13R29 for +24 VDC ± .05V. Refer to figure 6-22.

c. Set the power switch to ON and set the supply voltages using the DVM connected to the indicated pins: (See figure 6-22 for location of potentiometers).

	Voltage	Connector Pin	Control	Voltage Setting
15.1	+12V	A11-12	A13R17	+11.995V +0V −.01V
15.2	12V	A11-11	A13R42	−11.995V +0V −.01V
15.3	+3.6V	A13-23	A13R8	+3.6V ± .03V
15.4	−5.2	A13-6	A13R34	−5.2V ± .03V
15.5	+24V	A13-12	A13R25	+24V ± .05V

Upon completion of these adjustments set the power switch to OFF and unplug the power cord. Remove extender from the regulator board and install the regulator board in the main frame. Connect power cord and set power switch to ON. Connect the oscilloscope probe to the connector pins indicated in the above table and check for oscillations. The scope should be set for maximum sensitivity (100 mV/cm) in the AC position.

6.15.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend the Power Supply Regulator PC Board A13 from the RF-808 main frame. Set the RF-808 controls for 5.000 MHz, CW mode, SWEEP OFF, 0 DBM. Refer to figure 6-22 for test points and component locations and figure 6-3 for the assembly schematic diagram. Prefix all reference designators in the following tables with A13.

TABLE 6-30. A13 TRANSISTOR VOLTAGE CHART
(Voltages are nominal, unless otherwise specified in Remarks Column)

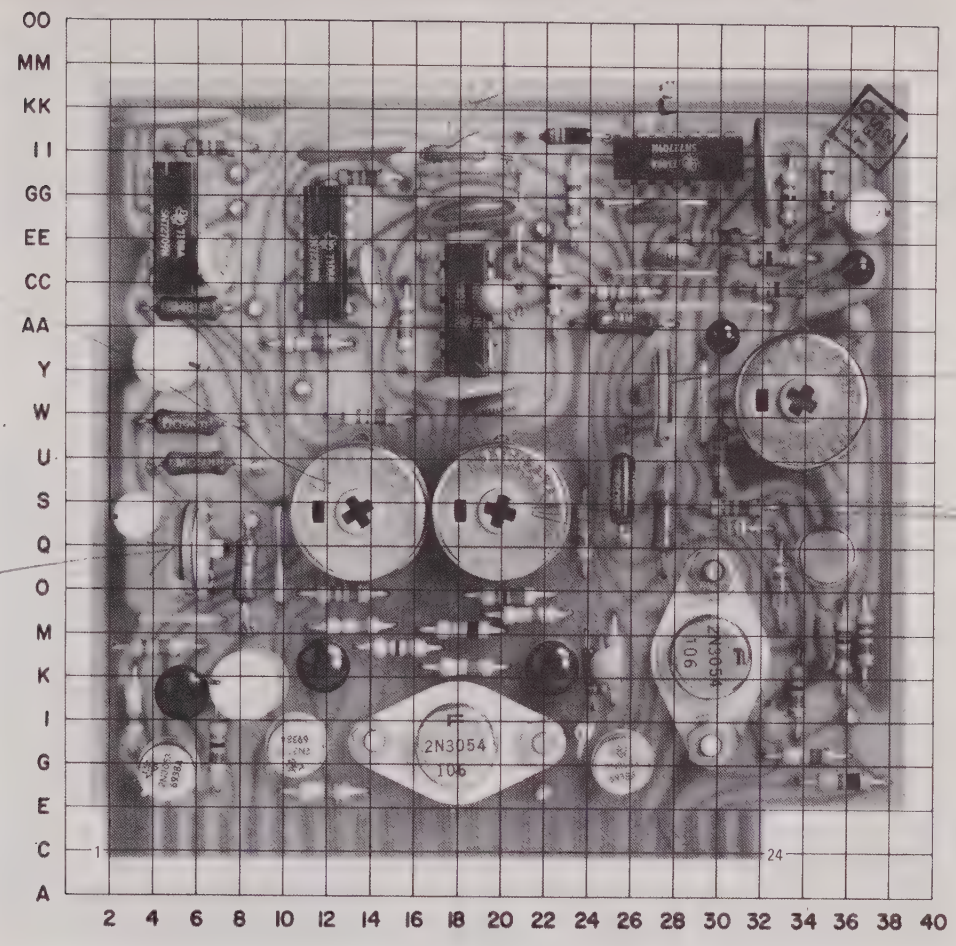
REF DESIG	VOLTS DC (±)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	+4.3	+4.9	+7	
Q2	+24.0	+23.3	+24.0	Emitter voltage is +24 ± .05 volts
Q3	−0.6	0	+7.7	
Q4	+12.6	+13.2	+16.7	
Q5	+25.2	+25.8	+31.1	
Q6	+24.6	+25.2	+31.2	
Q7	+0.1	+7.5	−7.2	
Q8	−7.9	−7.2	−5.2	
Q9	−0.7	−1.3	−14.9	
Q10	−15.4	−14.9	−12.0	Collector voltage is −12.0 ± .01 volts.

TABLE 6-31. A13 INTEGRATED CIRCUIT VOLTAGE CHART
(Voltages are nominal unless otherwise specified)

REF DESIG	PIN													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC1	–	+3.6	+3.6	+7.5	0	+4.9	+16.7	+17.0	+6.2	–	–	–	–	–
IC2	–	–	+19.2	+7.5	+7.5	0	0	–	+0.7	+13.2	+22.8	+19.5	–	–
IC3	–	–	+26.1	+7.5	+7.5	0	0	–	+0.7	+19.4	+31.0	+25.7	–	–
IC4	–	–	+12.1	0	0	−7.1	−7.1	–	−6.4	+7.5	+17.0	+13.6	–	–
IC5	–	–	+8.3	0	0	−5.2	−5.2	–	−4.5	−1.4	+12.0	+9.4	–	–

TABLE 6-32. A13 TEST POINT AND CONNECTOR PIN VOLTAGE CHART

REF DESIG	VOLTS DC	REMARKS
TP-1	+7.45 nominal	unregulated
TP-2	+3.6 ± .03	regulated
TP-3	+12.0 +0, −0.1	regulated
TP-4	+24.0 ± 0.5	regulated
TP-5	+31.0 nominal	unregulated
TP-6	−7.1 nominal	unregulated
TP-7	−16.2 nominal	unregulated
Connector Pin		
2	0	
3	−15.4 nominal	unregulated
4	−16.2 nominal	unregulated
5	−12.0 +0, −01	regulated
6	−5.2 nominal	unregulated
7	−7.9 nominal	unregulated
8	–	
9	−7.1 nominal	unregulated
10	-	
11	-	
12	+24.0 ± 05	regulated
13	–	
14	+24.6 nominal	unregulated
15	+31.0 nominal	unregulated
16	–	
17	+12.6 −.01	regulated
18	+12.0 −.01	regulated
19	+16.7 nominal	unregulated
20	+4.3 nominal	unregulated
21	+7.0 nominal	unregulated
22	+3.6 ± .03	regulated
23	+3.6 ± .03	regulated



A13

REF DESIG	LOCATION
C1	M,35
C2	S,36
C3	AA,36
C4	I,33
C5	GG,28
C6	II,32
C7	FF,37
C8	X,18
C9	GG,19
C10	BB,20
C11	CC,14
C12	II,12
C13	DD,7
C14	KK,4
C15	R,3
C16	DD,28
C17	W,20
C18	Y,4
C19	K,8
C20	L,25
CR1	O,33
CR2	R,30
CR3	FF,21
IC1	Q,35
IC2	II,28
IC3	CC,18
IC4	EE,12
IC5	EE,5
Q1	K,30
Q2	AA,30
Q3	DD,36
Q4	G,26
Q5	K,22
Q6	G,18
Q7	K,12
Q8	H,10
Q9	J,5
Q10	G,4
R1	K,34
R2	H,35
R3	S,31
R4	DD,32
R5	CC,33
R6	M,36
R7	M,37
R8	W,34
R9	U,30
R11	GG,33
R12	M,25
R13	GG,23
R14	EE,30
R15	HH,35
R16	R,27
R17	Y,28
R18	AA,26
R19	M,18
R20	N,22
R21	K,18
R22	O,20
R23	AA,16
R24	CC,22
R25	S,20
R26	Q,24
R27	CC,26
R28	FF,16
R29	II,18
R30	F,12
R31	L,16
R32	M,13
R33	O,13
R34	S,14
R35	W,14
R36	Z,11
R37	HH,14
R38	I,3
R39	H,7
R40	II,6
R41	P,8
R42	Q,6
R43	U,6
R44	L,4
R45	W,6
R46	BB,6
R47	F,36
R48	T,26
R50	I,24
VR1	JJ,23
VR2	K,24

Test Points	
TP1	BB,9
TP2	I,36
TP3	FF,8
TP4	EE,22
TP5	F,22
TP6	X,11
TP7	HH,8
TP8	V,26
TP9	Q,26
TP10	R,8
TP11	M,8
TP12	U,4
TP13	U,9

Figure 6-22. Parts Location, Assembly A13 (REV M).

6.16 VHF LOOP A MODULE A14.

6.16.1 Circuit Description.

VHF Loop A Module A14 contains the five printed circuit board assemblies listed below. The functions performed are:

A14A1	–	300 MHz Mixer
A14A2	–	300 MHz VCO
A14A3	–	280 MHz Mixer
A14A4	–	270–280 MHz VCO
A14A5	–	280–300 MHz Loop and 20–30 MHz Phase Detector

Refer to the block diagram figure 6-23. The output of VHF Loop A (A14) is a sine wave signal with a frequency lying within the range of 270–280 MHz in integral multiples of 1 kHz. The stability of the input signal is the same as that of the 280–350 MHz VCO on A15. These two signals are mixed in the output mixer on A18 and the instability is cancelled to produce a stable generator output locked to the 1 MHz standard.

The 300 MHz mixer (A14A1) receives inputs from the 300 MHz VCO and the 320 MHz from VHF Loop B Module A15. The 20 MHz mixer (A14A1) output is compared with the 20 MHz phase-locked signal in the 20 MHz phase detector. The DC error is amplified and used to control the 300 MHz VCO, to maintain the 300 MHz mixer output at 20 MHz, phase-locked to the 1 MHz standard.

The 280 MHz mixer receives inputs from the 270–280 MHz VCO and the 300 MHz VCO. The difference frequency lying within the range 20–30 MHz is used as one input to the 20–30 MHz phase detector; the other input is the synthesized 20–30 MHz signal from A8. The DC output of the phase detector is amplified and used to control the 270–280 MHz VCO in order to lock the output of the 280 MHz mixer to the 1 MHz frequency standard.

Circuit descriptions of VHF Loop A Module sub-assemblies A1 through A5 are provided below. Refer to schematic diagram, figure 6-26 in the following discussions.

NOTE

In the following discussion prefix all reference designators with A14A1, unless otherwise specified.

a. 300 MHz Mixer. The input from the 300 MHz VCO is at E4. The 300 MHz signal (terminated and attenuated by R14 and R15) drives the base of Q4. Q4 together with Q3 forms a cascode amplifier. The output at the collector of Q3 is coupled via T3 and T4 to mixer diodes CR1 through CR4. L7, L8, L9, C16 through C19 provide RFI filtering of the –12V DC supply lead. In an identical manner, the 320 MHz input at E1 is amplified by Q1 and Q2 and applied to the mixer diodes through impedance matching transformers T1 and T2. The 20 MHz difference frequency passes through low-pass filter L4, L5, L6, C8, C9 and C10 to output E2.

NOTE

In the following discussion prefix all reference designators with A14A2, unless otherwise specified.

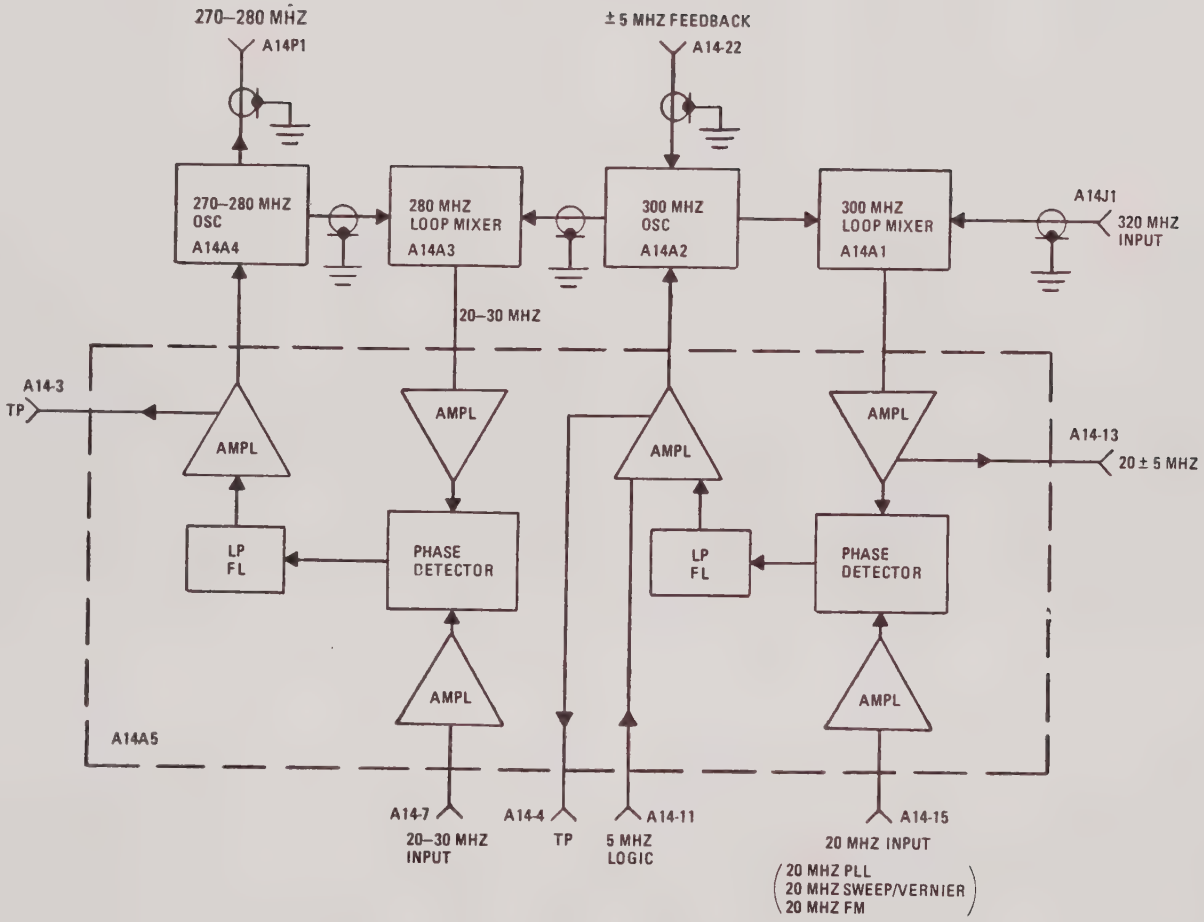


Figure 6-23 VHF Loop A Module A14, Block Diagram

b. 300 MHz VCO. The oscillator transistor Q1 associated with frequency-determining components L1, L2, CR1, C2, C3, C4 and C5 forms the basic oscillator. The positive control voltage is applied via L3, R1 and L2 in the cathode of varactor diode CR1. CR2 is non-conducting except when in the ± 5 MHz SWEEP mode. The oscillator output at the junction of C4 and C5 is applied to identical buffers Q2 and Q3. Q2 output drives the 300 MHz mixer (A14-A1) described above, and Q3 provides a 300 MHz signal to the 280 MHz mixer (A14A3). In the ± 5 MHz SWEEP mode, the positive sweep voltage is applied through C2 to the anode of CR1.

c. 280 MHz Mixer, A14A3. The operation of the 280 MHz mixer is identical to that of the 300 MHz mixer described above with the exception that the inputs are a 300 MHz signal and a 270–280 MHz signal providing a 20–30 MHz output.

NOTE

In the following discussion, prefix all reference designators with A14A4, unless otherwise specified.

d. 270–280 MHz VCO. The operation of the 270–280 MHz VCO is identical to that of the 300 MHz VCO except for frequency. Because no sweep operation is required, L1 is returned directly to ground.

NOTE

In the following discussion, prefix all reference designators with A14A5, unless otherwise specified.

e. 280–300 MHz Loop. The nominal 20 MHz signal from the 300 MHz Mixer enters at E2 and is amplified by Q8 and Q7 before being applied (via T2) to phase detector diodes CR2 through CR5. The 20 MHz phase-locked signal enters at pin 15 and amplified by Q6 before being applied to the phase detector via T1. The DC output from the phase detector, at T2 pins 4 & 5, passes through a low-pass filter to IC1, pin 12. IC1 is used as a differential amplifier, the gain being set by the values selected for R10 and R11. The amplifier output of IC1 pin 7 is fed via R18 to E1, the control line for the 300 MHz VCO.

If the nominal 20 MHz signal from the 300 MHz Mixer is outside the loop bandwidth, that is beyond capture range, there will be a beat signal at the output of IC1, pin 7. This signal is buffered by Q1 and detected by CR1, which develops a voltage across C26 turning on Q5. This returns R28 in the emitter circuit of Q4 to the –12V line. Q4 is in a grounded base oscillator circuit with a frequency, determined by L5, C22 and C23, of approximately 12 kHz. The oscillator output is coupled by C21 and R12 to pin 9 of IC1. This signal then sweeps the 300 MHz VCO until its frequency comes within the locking bandwidth and is captured. When this happens there is no high-frequency beat from the differential amplifier, Q5 turns off and the sweep oscillator is switched off. The output of the DC amplifier can be monitored at A14 pin 4.

When in the ± 5 MHz sweep mode, the 300 MHz VCO is no longer controlled by referencing it to the 20 MHz phase-locked signal, but by an input from the Discriminator PC Board A16. The signal to the discriminator has a center frequency of 4 MHz obtained from A17 by dividing the nominal 20 MHz beat from the 300 MHz mixer by 5 . This signal is taken from the collector of A14A5Q7, buffered by emitter follower Q9 and leaves at A14 pin 13. The 300 MHz

VCO control voltage (± 5 MHz Feedback) from the Discriminator PC Board enters at A14 pin 22, and is filtered before being applied to the anode of CR1 on A14A2. At the same time the differential amplifier A14A5IC1 is disabled as follows. A14 pin 11 is at −5.2 volts, Q2 is held off, which turns on Q3. The emitter of Q3 and hence pin 3 of IC1 is held at approximately +3 volts. Pins 5, 6 and 7 of IC1 are then close to +12 volts, and as pin 7 is connected via series resistors to the cathode of CR1 on A14A2, this is also held close to +12 volts. The ± 5 MHz positive sweep voltage on the anode of CR1 varies its capacitance and hence the frequency of the 300 MHz VCO by up to ± 5 MHz. This causes the output of the 300 MHz mixer and hence the signal on A14 pin 13 to vary by ± 5 MHz.

f. 20–30 MHz Phase Detector A14A5. The operation of the 20–30 MHz phase detector is identical to that used in the 280–300 MHz Loop except for frequency. The 20–30 MHz signal from the 280 MHz Mixer enters at E4 and its phase is compared with that of the synthesized 20–30 MHz signal, entering at A14 pin 7. The DC output of the phase detector is amplified by IC2 and appears as an output at E3. This signal then controls the frequency of the 270–280 MHz VCO on A14A4.

6.16.2 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter, and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend VHF Loop Module A14 from the RF-808 main frame. Set the RF-808 controls to CW mode unless other specified in REMARKS column. Refer to figure 6-24, 6-25 for test points and component locations and figure 6-26 for the assembly schematic diagram.

TABLE 6-33. A14 VOLTAGE AND WAVEFORM CHART

REF DESIG	VOLTAGE/WAVEFORM	REMARKS
A14A1		
Q1C	300 mV rms @ 320 MHz	
Q2B	300 mV rms @ 320 MHz	
Q3C	100 mV rms @ 300 MHz	
Q4B	60 mV rms @ 300 MHz	
A14A2		
Q1B	130 mV rms on −5.7 VDC level, frequency 300 MHz	
Q2C	300 mV rms @ 300 MHz	
Q3C	300 mV rms @ 300 MHz	

TABLE 6-33. A14 VOLTAGE AND WAVEFORM CHART (Cont)

REF DESIG	VOLTAGE/WAVEFORM	REMARKS
A14A3		
Q1C	200 mV rms @ 300 MHz	
Q2B	300 mV rms @ 300 MHz	
Q3C	170 mV rms @ 270–280 MHz	
Q4B	60 mV rms @ 270–280 MHz	
A14A4		
Q1B	170 mV rms on –5.7 VDC level, frequency 270–280 MHz	
Q2C	300 mV rms @ 270–280 MHz	
Q3C	300 mV rms @ 270–280 MHz	
A14A5		
Q2B	–5.2 VDC	± 5 MHz SWEEP button depressed
Q2C	+7.4 VDC	± 5 MHz SWEEP button depressed
Q3B	+2.7 VDC	± 5 MHz SWEEP button depressed
Q3E	+2.0 VDC	± 5 MHz SWEEP button depressed
Q6B	500 mV p-p @ 20 MHz, on –5.5 VDC level	
Q6C	800 mV p-p @ 20 MHz, on 0 VDC level	
Q7B	160 mV p-p @ 20 MHz, on –5.7 VDC level	
Q7C	400 mV p-p @ 20 MHz, on 0 VDC level	
Q8B	60 mV p-p @ 20 MHz, on –5.6 VDC level	
Q9E	400 mV p-p @ 20 MHz, on –6.1 VDC level	
Q13B	500 mV p-p @ 20–30 MHz, on –5.5 VDC level	
Q13C	800 mV p-p @ 20–30 MHz, on 0 VDC level	
Q14B	160 mV p-p @ 20–30 MHz, on –5.7 VDC level	
Q14C	400 mV p-p @ 20–30 MHz, on 0 VDC level	
Q15B	60 mV p-p @ 20–30 MHz, on –5.6 VDC level	
IC1-2	–0.7 VDC	When LOOP A is locked
IC1-5	+5.8 VDC	When LOOP A is locked
IC1-7	+5.2 VDC	When LOOP A is locked
IC1-12	0 VDC	When LOOP A is locked

PARTS LOCATION GUIDE FOR FIGURE 6-24, ASSEMBLIES A14A1 THROUGH A14A4

A14A1

REF DESIG	LOCATION
C1	Y,26
C2	X,23
C3	AA,25
C4	CC,25
C5	EE,24
C6	DD,28
C7	II,28
C8	CC,33
C9	FF,34
C10	JJ,35
C11	Z,27*
C12	W,39*
C13	X,40
C14	Z,43
C15	V,41
C16	AA,39
C17	EE,39
C18	GG,39
C19	HH,38
CR1	Z,33
CR2	X,33
CR3	Y,33
CR4	W,33
L1	DD,24
L2	EE,26
L3	FF,27
L4	BB,31
L5	EE,31
L6	HH,32
L7	CC,39
L8	DD,37
L9	FF,37
Q1	Y,27
Q2	Y,24
Q3	X,39
Q4	X,41
R2	AA,22
R3	W,27
R4	W,25
R5	Y,23
R6	Z,28
R7	AA,23
R8	HH,34
R9	X,37
R10	Z,38
R11	Z,39
R12	Y,41
R13	X,43
R14	CC,44
R15	CC,42*
R16	GG,42
T1	X,29
T2	X,31
T3	X,34
T4	X,36

A14A2

REF DESIG	LOCATION
C1	M,41
C2	O,40
C3	M,40
C4	M,37
C5	O,37
C6	J,40
C7	O,36
C8	P,32
C9	N,32
C10	P,30
C11	K,36
C12	H,33
C13	F,33
C15	E,42
C16	G,37
C17	Q,39
C18	R,41
C19	J,43
CR1	M,43
CR2	Q,43
L1	P,41
L2	L,43
L3	H,42
L4	G,39
L5	N,31
L6	E,36
L7	F,41
L8	E,39
L9	P,44
Q1	N,39
Q2	P,33
Q3	J,33
R1	J,42
R2	N,41
R3	J,41
R4	J,38
R7	O,35
R8	N,34
R9	R,33
R10	N,33
R13	K,34
R14	H,35
R15	I,31
R16	G,34
R17	R,40

A14A3

REF DESIG	LOCATION
C1	O,22
C2	Q,25
C3	N,24
C4	L,23
C5	I,24
C6	K,20
C7	F,20
C8	K,15
C9	I,14
C10	D,13
C11	N,21*
C12	R,9*
C13	Q,8
C14	O,6
C15	R,7
C16	M,10
C17	J,9
C18	H,9
C19	F,10
CR1	O,15
CR2	Q,15
CR3	P,15
CR4	R,15
L1	K,24
L2	I,22
L3	H,21
L4	M,17
L5	J,17
L6	G,16
L7	L,9
L8	J,11
L9	H,11
Q1	P,21
Q2	O,24
Q3	Q,9
Q4	Q,7
R2	N,26
R3	Q,21
R4	Q,24
R5	O,25
R6	O,20
R7	M,25
R8	F,14
R9	R,11
R10	N,10
R11	O,9
R12	O,7
R13	Q,5
R14	L,4
R15	K,5*
R16	H,6
T1	P,19
T2	P,17
T3	P,14
T4	P,12

A14A4

REF DESIG	LOCATION
C1	DD,16
C2	FF,14
C3	DD,14
C4	DD,12
C5	FF,12
C6	AA,14
C7	FF,10
C8	HH,6
C9	EE,6
C10	GG,5
C11	CC,10
C12	Y,7
C13	X,6
C15	V,15
C16	X,11
CR1	DD,17
L1	GG,16
L2	BB,17
L3	Y,16
L4	X,13
L5	DD,5
L6	V,10
L7	W,15
L8	V,13
Q1	EE,13
Q2	GG,8
Q3	AA,7
R1	AA,16
R2	EE,15
R3	BB,15
R4	AA,12
R7	FF,9
R8	EE,8
R9	II,7
R10	EE,7
R13	AA,8
R14	Z,9
R15	Z,5
R16	Y,9

*Part on opposite side of PC Board and therefore not visible.

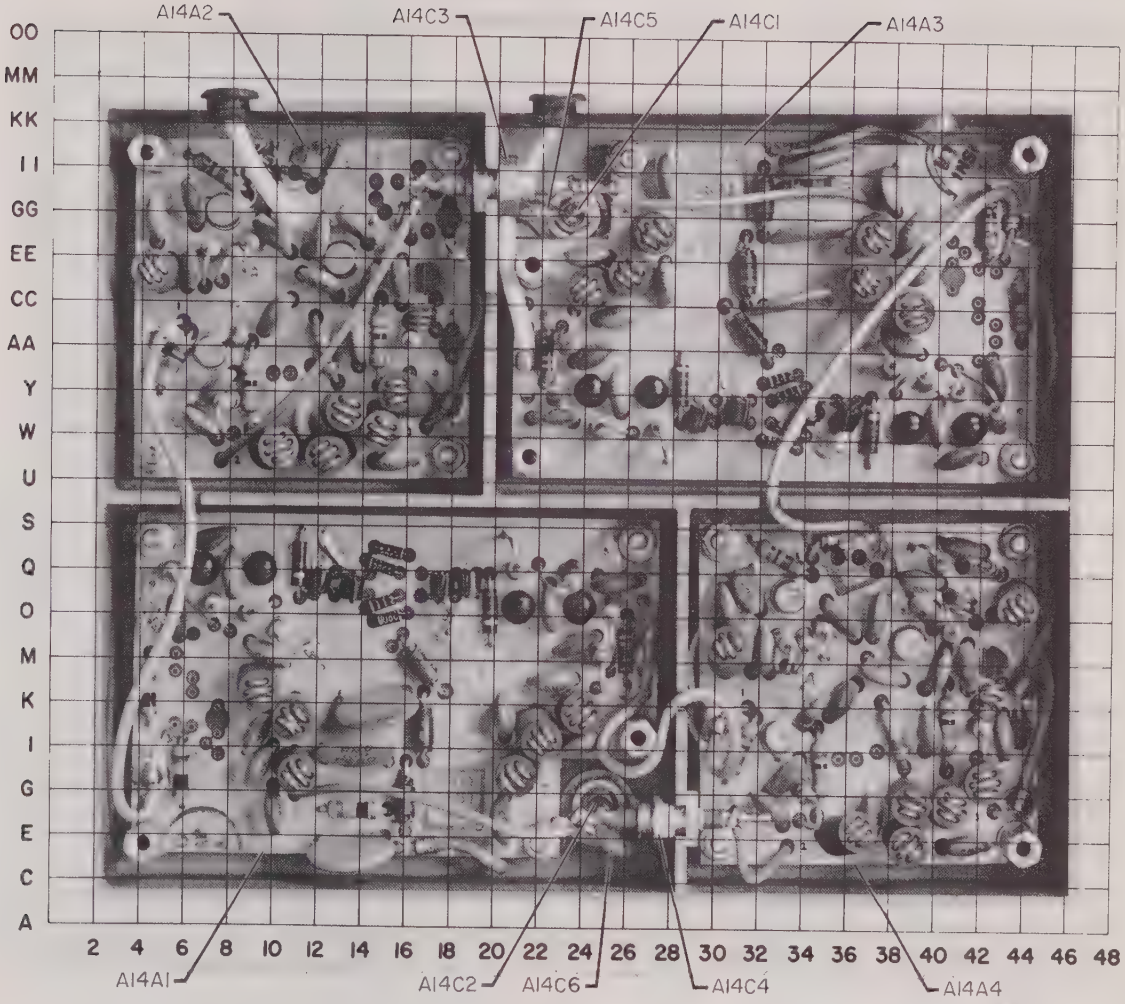


Figure 6-24. Parts Location, Assemblies A14A1 (REV G), A14A2 (REV D), A14A3 (REV G), and A14A4 (REV F).

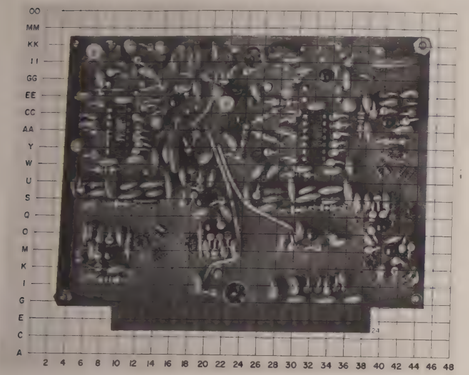
PARTS LOCATION GUIDE FOR FIGURE 6-25, ASSEMBLY A14A5

A14A5

REF DESIG	LOCATION
C1	G,31
C2	I,30
C3	G,34
C4	I,34
C5	V,27
C6	FF,29
C7	AA,28
C8	DD,32
C9	HH,31
C10	W,36
C11	DD,36
C12	GG,36
C13	II,41
C14	H,37
C15	J,36
C16	I,19
C17	Z,22
C18	M,23
C19	V,25
C20	W,31
C21	FF,25
C22	EE,23
C23	DD,25
C24	EE,20
C25	V,34
C26	JJ,26
C27	J,7
C28	II,29
C29	T,24
C30	S,27
C31	R,27
C32	T,30
C33	S,31
C34	T,31
C35	T,34
C36	S,34
C37	T,36
C38	AA,38
C39	AA,42
C40	DD,41
C41	FF,43
C42	S,40
C43	S,38
C44	DD,38
C45	N,39
C46	O,42
C47	K,44
C48	S,37
C49	K,40
C50	N,35
C51	P,31
C52	N,29
C53	EE,5
C54	Y,4
C55	X,13
C56	BB,13
C57	X,11
C58	BB,6
C59	EE,10
C60	FF,17
C61	W,8
C62	Y,16
C63	GG,7
C64	II,9
C65	HH,11
C66	KK,14
C67	KK,14
C68	JJ,17
C69	KK,20
C70	FF,18
C71	U,4
C72	T,7
C73	R,6
C74	T,9
C75	T,11
C76	U,11
C77	U,14
C78	T,13
C79	T,15
C80	K,10
C81	O,10
C82	M,7
C83	O,6
C84	HH,12
C85	M,20
C86	M,22
C87	Q,22
C88	X,15
C89	Q,19
C90	V,17
C91	X.19
C92	U,20
C93	H,28
CR1	HH,29
CR2	V,43
CR3	V,39
CR4	Q,42
CR5	W,40
CR6	HH,17
CR7	O,14
CR8	M,14
CR9	P,15
CR10	L,15
IC1	Z,32
IC2	AA,9
L1	I,32
L2	I,33
L3	I,35
L4	AA,21
L5	DD,22
L6	KK,28
L7	T,27
L8	R,31
L9	R,33
L10	DD,42
L11	Q,38
L12	J,43
L13	JJ,6
L14	JJ,18
L15	U,7
L16	R,9
L17	S,13
L18	P,7
L19	O,23
L20	V,18
L21	L,5
L22	AA,15
L23	EE,40
L24	GG,38
Q1	HH,33
Q2	BB,23
Q3	X,25
Q4	AA,21
Q5	II,22
Q6	BB,41
Q7	P,40
Q8	M,41
Q9	O,32
Q10	DD,15
Q11	JJ,9
Q12	II,14
Q13	L,9
Q14	P,20
Q15	S,19
R1	X,30
R2	Y,35
R3	W,34
R4	Z,35
R5	V,31
R6	R,32
R7	Z,30
R8	AA,35
R9	BB,29
R12	DD,29
R13	CC,30
R14	CC,34
R15	GG,30
R16	HH,34
R17	KK,34
R18	II,36
R19	KK,39
R20	H,21
R21	Z,27
R22	CC,27
R23	AA,24
R24	X,23
R25	X,27
R26	GG,19
R27	GG,21
R28	HH,22
R29	KK,22
R30	HH,24
R31	S.26
R32	BB,37
R33	CC,39
R34	CC,40
R35	Z,41
R36	BB,42
R37	CC,43
R38	R,41
R39	Q,40
R40	T,39
R41	P,39
R42	Q,39
R43	M,39
R44	M,42
R45	N,44
R46	K,42
R47	L,42
R48	O,34
R49	N,33
R50	N,30
R51	X,6
R52	Y,12

NOTES FOR FIGURE 6-26.

1. All resistance values are in ohm, 1/4 watt, unless otherwise specified.
2. All capacitance values are in microfarads, unless otherwise specified.
3. All inductance values are in microhenries, unless otherwise specified.
4. SEL = Selected Value.



REF DESIG	LOCATION
R53	Y,11
R54	Z,11
R55	W,7
R56	CC,11
R57	AA,6
R58	AA,11
R59	CC,6
R62	HH,8
R63	DD,7
R64	DD,12
R65	FF,14
R66	CC,14
R67	BB,16
R68	AA,18
R69	Y,17
R70	KK,8
R71	KK,12
R72	II,11
R73	II,15
R74	KK,16
R75	T,5
R76	J,9
R77	K,8
R78	L,7
R79	N,11
R80	N,9
R81	N,7
R82	N,19
R83	O,20
R84	M,21
R85	P,22
R86	O,22
R87	S,22
R88	S,18
R89	R,17
R90	T,19
R91	U,19
T1	X,41
T2	Q,43
T3	L,39
T4	N,12
T5	N,18
T6	T,21

Test Points	
TP1	FF,31
TP2	FF,35
TP3	DD,31
TP4	EE,35
TP5	JJ,35
TP6	II,33
TP7	KK,32
TP8	KK,30
TP9	FF,8
TP10	FF,12
TP11	EE,7
TP12	EE,11
TP13	AA,18
TP14	DD,18
TP15	CC,17
TP16	EE,17

Figure 6-25. Parts Location, Assembly A14A5 (REV F).

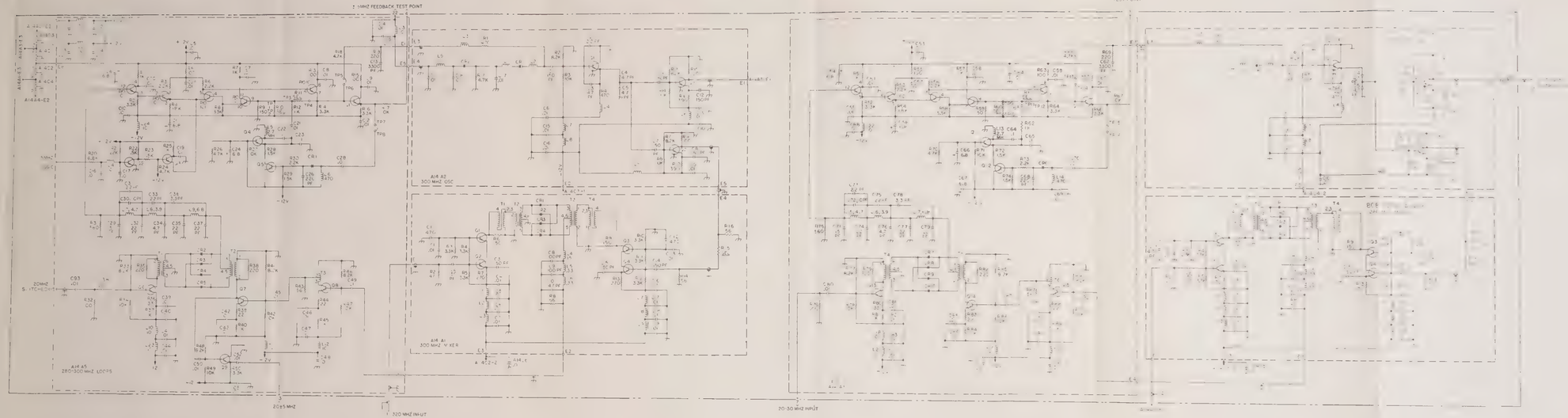


Figure 6-26. VHF Loop A Module A14, Schematic Diagram

6.17 VHF LOOP B MODULE A15.

6.17.1 Circuit Description.

The VHF Loop B Module A15 contains the five printed circuit board assemblies listed below.

A15A1	–	280–350 MHz VHF Amplifier
A15A2	–	280–350 MHz VCO
A15A3	–	320 MHz Mixer
A15A4	–	320 MHz VCO
A15A5	–	320 MHz Loop

Refer to the block diagram figure 6-27. The VHF Loop B Module A15 provides two output frequencies, one lying within the range 280–350 MHz in 10 MHz increments, as determined by the front panel tens MHz frequency control, the other, 320 MHz, controlled to maintain a phase-locked frequency difference with respect to the 280–350 MHz VCO. This difference frequency will be 0, 10, 20, 30 or 40 MHz depending on the setting of the tens MHz control.

The 320 MHz Mixer receives inputs from the 320 MHz VCO and the 280–350 MHz VCO. The difference frequency is amplified before its phase is compared with that of a 10 MHz phase-locked signal. The output of the phase detector is fed through an FET switch and low-pass filter to a DC amplifier, whose output controls the frequency of the 320 MHz VCO. When the tens MHz control is set to 4, the output of the 320 MHz mixer is nominally DC and is, therefore, routed by the FET switches to by-pass the phase detector. The state of the FET switches is determined by logic, controlled by DC levels from the tens MHz control.

Circuit descriptions of VHF Loop B Module sub-assemblies A1 through A5 are provided below. Refer to schematic diagram, figure 6-30 in the following discussions.

NOTE

In the following discussion prefix all reference designators with A15A1, unlesss otherwise specified.

a. 280–360 MHz Amplifier A15A1. This broadband amplifier consists of two cascaded class A amplifier stages operating in the common-emitter mode. The output of the 280–350 MHz VCO A15A2 is connected to the input to the amplifier at E1. The output of the amplifier is taken from the collector of Q2 via coaxial line to A15P2.

NOTE

In the following discussion, prefix all reference designators with A15A2 unless otherwise specified.

b. 280–350 MHz VCO. The 280–350 MHz VCO utilizes Q1 in the oscillator circuit, with frequency determining components L1, L2, CR1, C2, C3, C4 and C5. The varactor diode CR1 has a fixed bias on the anode of approximately –3 volts with additional power supply filtering provided by C17, C18 and L9. Thermistor R19 provides some temperature compensation for the oscillator. The positive control voltate for CR1 is applied through R1and L3 from the 320 MHz Loop A15A5. This voltage is varied step-wise as the tens MHz control is switched, in order to set the oscillator to the appropriate 10 MHz increment. The oscillator output at the junction

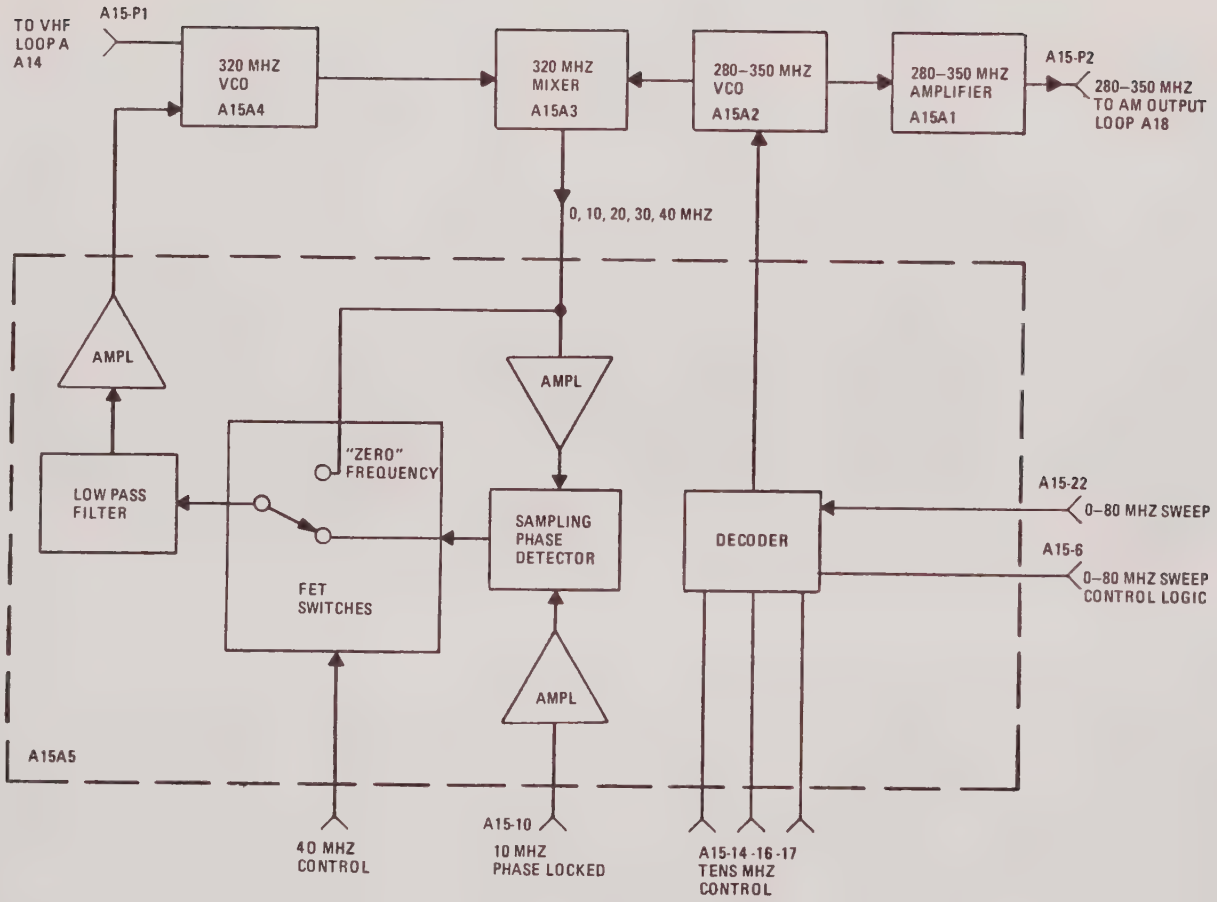


Figure 6-27. VHF Loop B Module A15, Block Diagram.

of C4 and C5 is buffered by two identical stages, one of which feeds the VHF AMPLIFIER A15A1 the other feeding the 320 MHz MIXER A15A3. It should be noted that this oscillator is not phase-locked but any errors thus caused are cancelled during the final mixing process in the AM OUTPUT Loop A18.

NOTE

In the following discussion prefix all reference designators with A15A3, unless otherwise specified.

c. 320 MHz Mixer. The input from the 320 MHz VCO is at E4. The 320 MHz signal (terminated and attenuated by R14 and R15) drives the base of Q4. Q4 together with Q3 forms a cascode amplifier. The output at the collector of Q3 is coupled via T3 and T4 to mixer diodes CR1 through CR4. L7, L8, L9, C16 through C19 provide filtering of the −12 VDC supply. In an similar manner, the 280–350 MHz input at E1 amplified by Q1 and Q2 and applied to the mixer diodes through impedance matching transformers T1 and T2. The difference frequency which will be 0, 10, 20, 30 or 40 MHz passes through low-pass filter L4, L5, L6, C8, C9 and C10 to output E2 from which it goes to the 320 MHz Loop A15A5. The function of CR5 is explained under the description of the 320 MHz Loop A15A5.

NOTE

In the following discussion prefix all reference designators with A15A4, unless otherwise specified.

d. 320 MHz VCO. The 320 MHz VCO utilizes Q1 in the oscillator circuit, with frequency determining components L1, L2, CR1, C2, C3, C4 and C5. The varactor diode CR1 has a fixed bias on the anode of approximately −4 volts, with additional power supply filtering provided by L9 and C17. The positive control voltage for CR1 is applied through R1 and L3 from the 320 MHz Loop A15A5. This voltage is derived from the phase detector except when the tens MHz control is set to 4, in which case it is derived from the 320 MHz Mixer output. The oscillator output at the junction of C4 and C5 is buffered by two identical stages, one of which feeds the 320 MHz Mixer A15A3, the other feeding the 300 MHz Mixer A14A1.

NOTE

In the following discussion, prefix all reference designators with A15A5, unless otherwise specified.

e. 320 MHz Loop. The signal from the 320 MHz mixer is nominally 0, 10, 20, 30 or 40 MHz depending on the setting of the tens MHz control. The "zero" frequency signal is processed in a different manner from the others and is described first.

"Zero" frequency is obtained when the tens MHz control is set to 4. IC1 pin 6 will then be high and Q15 turns on. Q16 then turns on and holds the gate of Q22 at ground potential. Q22 then allows the mixer signal on E3 to pass directly through the low-pass filter to pin 12 of IC4, connected as a differential amplifier. The other input to IC4 is pin 9 and the output is pin 7. The voltage gain is determined by the ratio of R77 to R78. The DC signal on IC4 pin 7 is buffered by emitter follower Q19 and appears on A15 pin 12 via R86. The output of IC4 is also attenuated by R80 and R81, limited by CR7 and CR8 and applied via R82 and E2 to the control line of the

320 MHz VCO, thus closing the phase-lock loop.

In the "zero" frequency condition, when Q16 turns on, Q17 turns off and the gate of Q23 is held close to −12V. Q23 is then non-conducting and isolates the circuitry associated with the phase detector from the input to IC4 pin 12. At the same time the emitter of Q18 is pulled close to −12V and this causes E1 to go negative. This point is connected via L10 to the cathode of CR5 both located on A15A5. CR5 conducts and effectively bypasses R15, thus increasing the level of the 320 MHz input to the 320 MHz mixer. This increases the mixer output level to compensate for the loss of gain otherwise provided by the bypassed phase detector circuitry.

If the 320 MHz mixer output signal is outside the locking range of the loop, there will be a relatively high difference frequency signal from the emitter of Q19. This is coupled by C73 to CR6 where it is rectified to produce a positive voltage at the cathode of CR6 relative to the −12V line.Q21 turns on and provides a return to −12V for the grounded base oscillator comprising Q20, L14, C76 and C77. The oscillator output at approximately 10 kHz is coupled through C74 and R87 to pin 9 of IC4, the differential amplifier. This sweeps the control voltage to the 320 MHz VCO until the loop captures and locks. The high frequency beat is then no longer present and the sweep oscillator turns off.

At settings of the tens MHz control other than 4, IC1 pin 6 is low; consequently Q22 is off and Q23 is on. The 320 MHz mixer output signal present on E3 is amplified by cascaded wide-band amplifiers Q10 and Q11, from which it goes to the sampling diode bridge CR2, CR3, CR4 and CR5. A 10 MHz signal phase-locked to the frequency standard enters at A15 pin 10 and is amplified by gates 1-2-3 and 4-5-6 of IC3 and appears at pin 6 of IC3 as a square wave. This signal is applied directly to pin 9 and after inversion to pin 10. The inverter gate 11-12-13 delays the signal by a few nanoseconds. Pins 9 and 10 are thus both low for the duration of this delay and thus the signal on pin 8 of IC3 is a positive going pulse, a few nanoseconds wide. This is amplified by Q12 and coupled by T3 to turn on diodes CR2, CR3, CR4 and CR5 for this short sampling period. These diodes are matched and thus, during the sampling period, the junction of CR2 and CR3 is at the same potential as the junctions of CR4 and CR5. The mixer signal at the former junction, therefore appears unchanged at the latter and C42 holds the signal voltage until the next sampling interval. As the phase of the signal approaches that of the sampling pulse, the voltage across C42 increases. This voltage is buffered by complementary emitter followers Q13 and Q14, attenuated by R64, R65 and R97 before passing through Q23 to the low-pass filter and IC4. The output of IC4 then controls the 320 MHz VCO as described above.

Three binary-coded decimal data lines from the tens MHz control enter at pins 14, 16 and 17 of A15. These are decoded by IC1 to produce a logic high on one of seven output lines or none. When the tens MHz control is set to 7 and SWEEP is OFF, Q2 through Q9 are off, R3, R11 and R19 form a potential divider across the +12V supply. The voltage at the junction of R3 and R11 is then applied via R27 to the control line of the 280–350 MHz VCO, and sets the frequency accordingly. If, for example, the tens MHz control is set to 1, pin 9 of IC1 is high and Q4 turns on. This connects R5 and R13 in parallel with R11 and R19 and reduces the voltage on the VCO control line to the level appropriate to the frequency selected. The action is similar for Q3 through Q9. Trimmer resistors R4 through R11 allow the VCO control voltage to be adjusted for each position of the tens MHz control. When the 0–80 MHz SWEEP mode is selected, A15 pin 6 is low and Q1 is off. Q2 turns on and holds one end of R27 at ground potential, removing the positive bias from the VCO control line. The 0–80 MHz SWEEP signal on A15 pin 22 is then applied to the VCO control line via CR1 and L21, and thus sweeps the 280–350 MHz VCO, and hence the generator output frequency.

6.17.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position prior to removing module A15 from main frame.

a. Remove module A15 (paragraph 5.3.6). Extend module from main frame using Extender cable 808-0356. Refer to figures 6-28, 6-29.

b. Isolate connector pin 15.

c. Set the RF-808 to 0–80 MHz MAN SWEEP mode. Set the tens MHz control to 7.

d. Terminate A15P1 with a 50-ohm load.

e. Connect a frequency counter to either A15P2 or A15A1E3 through a 20 dB pad.

f. Connect the regulated power supply set for +9 VDC to connector pin A15-22.

g. Energize the RF-808. Connect a voltmeter to terminal A15E4 and monitor the voltage. Adjust the regulated power supply to obtain a voltmeter reading of 8.5 ± 0.1 volts.

h. Adjust A15A2L1 and L2 for a frequency counter reading of 360 MHz ± 300 kHz.

i. Disconnect the power supply. The frequency should now be between 260 to 275 MHz. If the frequency is below 260 MHz, readjust the power supply (step g) for a voltage of +8.1 ± 0.1 and repeat step h. If the frequency is above 275 MHz, readjust the power supply for a voltage of 8.9 ± 0.1 and repeat step h.

j. Depress the SWEEP OFF button. Adjust A5R11 for a frequency of 351 MHz ± 300 kHz. For all other positions of the tens MHz control, adjust the appropriate resistors for the frequencies indicated in the following chart.

Tens MHz Control	Resistor	Frequency ± 300 kHz
0	A15R4	281 MHz
1	A15R5	291 MHz
2	A15R6	301 MHz
3	A15R7	311 MHz
4	A15R8	321 MHz
5	A15R9	331 MHz
6	A15R10	341 MHz

6.17.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend VHF Loop Module B A15 from the RF-808 main frame. Set the RF-808 tens MHz control at "0" unless otherwise specified in the REMARKS column. Refer to figure for test points and component locations and figure for the assembly schematic diagram.

TABLE 6-34. A15 VOLTAGE AND WAVEFORM CHART

REF DESIG	VOLTAGE/WAVEFORM	REMARKS
A15A1		
Q1B	400 mV rms @ 280 MHz	
Q2B	580 mV rms @ 280 MHz	
Q2C	1V rms @ 280 MHz	
A15A2		
Q2B	240 mV rms @ 280 MHz	
Q2C	400 mV rms @ 280 MHz	
Q3B	240 mV rms @ 280 MHz	
Q3C	400 mV rms @ 280 MHz	
A15A3		
Q1C	450 mV rms @ 280 MHz	
Q2B	300 mV rms @ 280 MHz	
Q3C	95 mV rms @ 320 MHz	
Q4B	45 mV rms @ 320 MHz	
A15A4		
Q2B	200 mV rms @ 320 MHz	
Q2C	350 mV rms @ 320 MHz	
Q3B	200 mV rms @ 320 MHz	
Q3C	300 mV rms @ 320 MHz	
A15A5		
Q1B	+0.6 VDC	
Q1C	+0.1 VDC	
Q2B	+0.1 VDC	
Q3B	+0.6 VDC	
Q4B	+0.1 VDC	
Q5B	+0.1 VDC	
Q6B	+0.1 VDC	
Q7B	+0.1 VDC	

TABLE 6-34. A15 VOLTAGE AND WAVEFORM CHART (Cont)

REF DESIG	VOLTAGE/WAVEFORM	REMARKS
Q8B	+0.1 VDC	
Q9B	+0.1 VDC	
Q10B	60 mV p-p @ 40 MHz	
Q11B	120 mV p-p @ 40 MHz	
Q11C	450 mV p-p @ 40 MHz	
Q12B	160 mV positive going pulses approx 20 nano-seconds wide at 10 MHz rate on −5.6 VDC level	
Q12C	500 mV negative going pulses approx 20 nano-seconds wide at 10 MHz rate on a 0 VDC level.	
Q14E	+0.1 VDC	
Q15B	+0.6 VDC	Tens' MHz set to 4
Q16C	−0.1 VDC	Tens' MHz set to 4
Q17C	−9.0 VDC	Tens' MHz set to 4
Q18E	−5.6 VDC	Tens' MHz set to 4
Q19E	+3.0 VDC	Tens' MHz set to 4
Q19E	+2.8 VDC	
IC1-3	+0.1 VDC	
IC1-5	+0.1 VDC	
IC1-6	+0.1 VDC	
IC1-7	+0.1 VDC	
IC1-8	+0.1 VDC	
IC1-9	+0.1 VDC	
IC1-10	+2.4 VDC	
IC4-7	+3.6 VDC	
IC4-12	+0.2 VDC	

PARTS LOCATION GUIDE FOR FIGURE 6-28, ASSEMBLIES A15A1 THROUGH A15A4

A15A1

REF DESIG	LOCATION
C1	BB,30
C3	CC,32
C4	FF,35
C5	DD,29
C6	HH,27
C7	AA,36
C8	X,39
C10	FF,41
C11	DD,36
C12	II,33
C13	II,29
C14	CC,35*
L1	Y,34
L2	FF,27
L3	JJ,28
L4	Y,42
L5	KK,34
L6	KK,31
Q1	BB,33
Q2	AA,40
R1	Y,30
R2	DD,30
R4	FF,33*
R5	FF,30
R6	Y,37
R7	DD,37
R8	Y,38
R9	FF,40*
R10	GG,38
R11	II,38

A15A2

REF DESIG	LOCATION
C1	M,42
C2	P,40
C3	M,41
C4	M,38
C5	P,38
C6	J,40
C7	O.36
C8	Q,32
C9	N,32
C10	P,30
C11	L,36
C12	H,33
C13	G,32
C15	E,42
C16	F,37
C17	Q,40
C18	S,42
CR1	N,43
L1	P,42
L2	L,43
L3	H,43
L4	G,38
L5	N,29
L6	D,35
L7	F,41
L8	E,38
L9	P,44
Q1	N,39
Q2	Q,33
Q3	J,33
R1	J,42
R2	O,41
R3	J,41
R4	J,38
R7	O,35
R8	N.34
R9	R,33
R10	N,33
R13	K,34
R14	H,35
R15	J,31
R16	G,34
R17	R,40
R18.	R,42

A15A3

REF DESIG	LOCATION
C1	P,22
C2	Q,25
C3	N,23
C4	M,22
C5	I,22
C6	K,20
C7	F,20
C8	L,14
C9	I,14
C10	E,13
C11	O,20*
C12	S,9*
C13	R,7
C14	O,5
C15	S,6
C16	N,9
C17	J,8
C18	H,8
C19	F,9
C20	M,7*
C21	H,7
CR1	O,14
CR2	R,14
CR3	P,14
CR4	S,14
CR5	M,5*
L1	K,23
L2	K,21
L3	H,20
L4	M,16
L5	J,16
L6	G,15
L7	L,8
L8	K,10
L9	H,11
L10	J,7
Q1	P,21
Q2	P,23
Q3	R,9
Q4	R,6
R2	N,26
R3	R,20
R4	R,23
R5	P,25
R6	P,19
R7	M,24
R9	R,10
R10	O,9
R11	O,8
R12	P,6
R13	Q,5
R14	L,3
R15	L,5*
R16	H,5
T1	Q,19
T2	Q,17
T3	Q,13
T4	Q,11

A15A4

REF DESIG	LOCATION
C1	EE,14
C2	HH,13
C3	EE,13
C4	EE,11
C5	HH,11
C6	BB,13
C7	GG,9
C8	II,5
C9	FF,5
C10	HH,3
C11	DD,9
C12	Z,6
C13	Y,5
C15	W,14
C16	X,10
C17	II,13
CR1	EE,16
L1	HH,14
L2	DD,16
L3	Z,16
L4	Z,11
L5	FF,4
L6	X,9
L7	X,14
L8	W,12
L9	BB,17
Q1	FF,12
Q2	HH,7
Q3	BB,6
R1	BB,15
R2	GG,14
R3	BB,14
R4	BB,11
R7	GG,8
R8	FF,7
R9	JJ,6
R10	FF,6
R13	CC,7
R14	Z,8
R15	AA,4
R16	Y,7
R17	JJ,13
R18	II,15

*Part on opposite side of PC Board and therefore not visible.

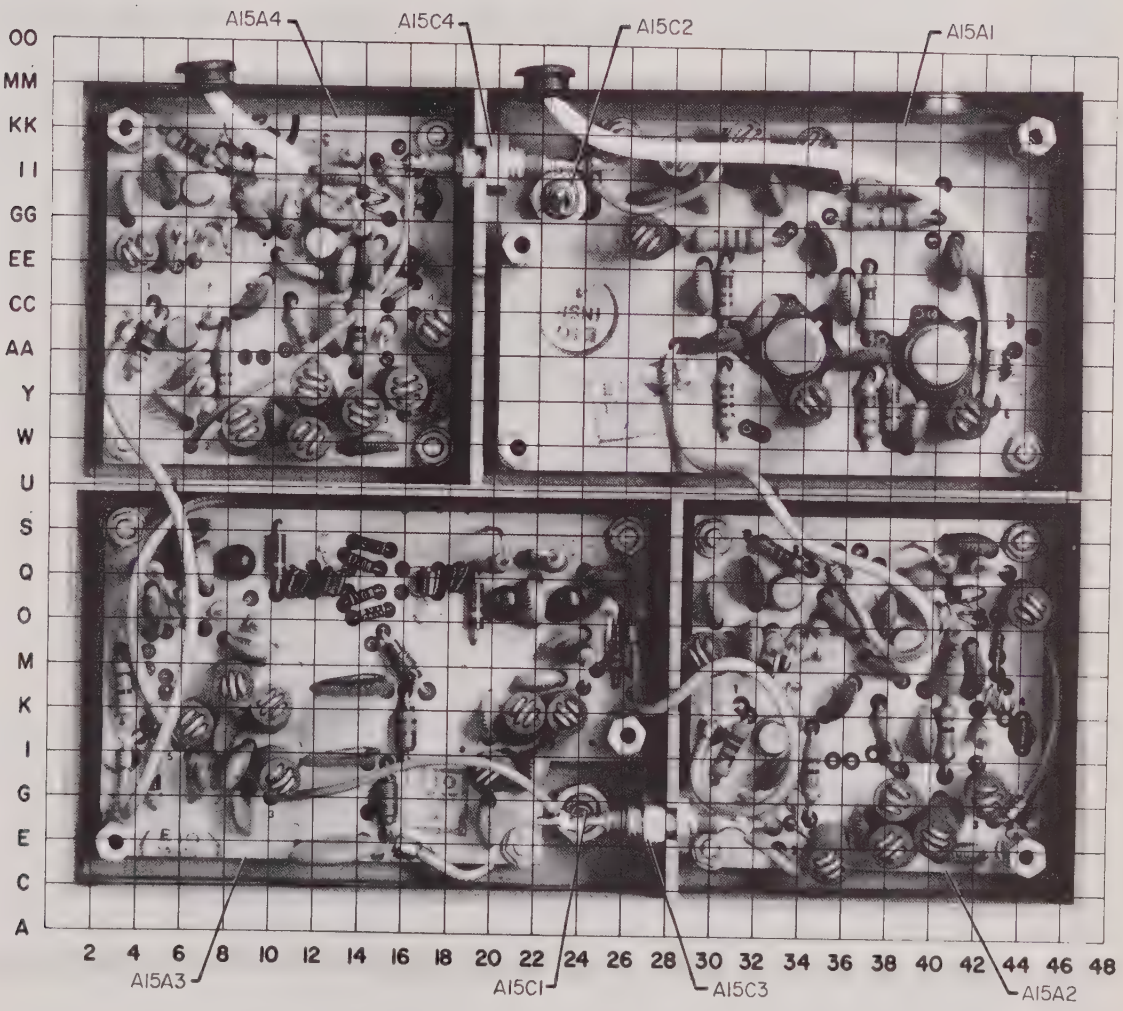


Figure 6-28. Parts Location, Assemblies A15A1 (REV C), A15A2 (REV F), A15A3 (REV G), and A15A4 (REV D).

PARTS LOCATION GUIDE FOR FIGURE 6-29, ASSEMBLY A15A5

A15A5

REF DESIG	LOCATION
C1	F,31
C2	I,31
C3	G,34
C4	I,34
C5	G,40
C6	H,41
C7	K,43
C8	H,37
C9	F,15
C10	I,36
C11	H,38
C12	F,27
C13	J,25
C14	H,27
C15	I,27
C16	G,30
C17	I,30
C18	JJ,37
C19	JJ,35
C20	JJ,43
C21	JJ,39
C22	J,45
C23	Q,44
C25	HH,10
C26	HH,7
C27	DD,7
C28	GG,5
C29	DD,10
C30	BB,5
C31	Z,8
C32	W,6
C33	U,4
C34	I,5
C35	I,12
C36	L,12
C37	O,10
C38	N,11
C39	P,6
C40	V,7
C41	Q,4
C42	V,12
C43	T,13
C44	Z,17
C45	DD,17
C46	BB,17
C47	X,23
C48	G,17
C49	R,17
C50	S,20
C51	II,20
C52	FF,21
C53	II,22
C54	II,23
C55	FF,24
C56	HH,27
C57	HH,29
C58	II,31
C59	DD,31
C60	BB,30
C61	CC,28
C62	BB,25
C63	BB,26
C64	FF,17
C65	X,32
C66	U,29
C67	J,14
C68	O,16
C69	R,15
C70	P,27
C71	Q,29
C72	W,24
C73	Q,23
C74	P,31
C75	L,28
C76	N,31
C77	O,28
C78	L,23
C79	N,22
C80	L,21
C81	G,13
CR1	I,43
CR2	V,11
CR3	V,8
CR4	V,10
CR5	V,9
CR6	P,22
CR7	L,19
CR8	L,17
IC1	M,38
IC3	M,5
IC4	Y,29
L1	I,32
L2	H,33
L3	J,41
L4	J,38
L5	H,25
L6	I,28
L7	I,29
L8	EE,4
L9	AA,4
L10	W,4
L11	K,10
L12	M,8
L13	S,5
L14	O,33
L15	N,20
L16	GG,21
L17	GG,24
L18	GG,30
L19	Y,24
L20	II,38
L21	L,45
Q1	O,43
Q2	R,42
Q3	EE,38
Q4	CC,38
Q5	AA,38
Q6	Y,38
Q7	W,38
Q8	U,38
Q9	R,39
Q10	GG,8
Q11	BB,8
Q12	R,8
Q13	Y,14
Q14	DD,15
Q15	BB,22
Q16	Z,22
Q17	V,20
Q18	T,19
Q19	S,25
Q20	M,29
Q21	O,26
Q22	JJ,15
Q23	HH,17
R1	N,42
R2	N,44
R3	KK,41
R4	GG,43
R5	EE,43
R6	CC,43
R7	AA,43
R8	Y,43
R9	V,43
R10	T,43
R11	II,43
R12	EE,40
R13	CC,40
R14	AA,40
R15	Y,40
R16	W,40
R17	U,40
R18	R,40
R19	HH,39
R20	CC,36
R21	AA,36
R22	Y,36
R23	W,36
R24	U,36
R25	R,37
R26	P,39
R27	S,44
R29	L,18
R31	CC,23
R32	CC,20
R33	AA,20
R34	Y,21
R35	X,20
R36	Y,20
R37	U,20
R38	V,22
R39	U,17
R40	T,17
R41	HH,12
R42	EE,8
R43	EE,6
R44	EE,12
R45	GG,6
R46	EE,5
R47	BB,11
R48	AA,8
R49	Y,10
R50	Z,6
R51	Y,5
R52	K,7
R53	P,8
R54	Q,6
R55	T,7
R56	S,6
R57	T,10
R59	W,15
R60	Y,17
R61	AA,15
R62	EE,16
R63	BB,15
R64	FF,15
R65	HH,14
R66	HH,32
R67	BB,32
R68	Z,27
R69	CC,30
R70	BB,28
R71	Y,27
R72	W,27
R73	Y,32
R74	X,27
R75	W,32
R76	T,31
R77	S,28
R79	U,27
R80	R,21
R81	P,18
R82	P,14
R83	L,13
R84	R,27
R85	U,25
R86	T,23
R87	S,32
R88	L,27
R89	M,26
R90	N,27
R91	M,25
R92	O,24
R93	K,42
R94	G,42
R95	U,15
R96	I,16
R98	L,16
T1	FF,10
T2	AA,11
T3	S,11

Test Points	
TP1	GG,14
TP2	GG,17
TP3	CC,14
TP4	W,14
TP5	W,18
TP6	Q,16
TP7	Q,17
TP8	T,24
TP9	S,23
TP10	R,24
TP11	T,26
TP12	T,30
TP13	P,30
TP14	JJ,32
TP15	FF,32
TP16	S,30
TP17	S,26

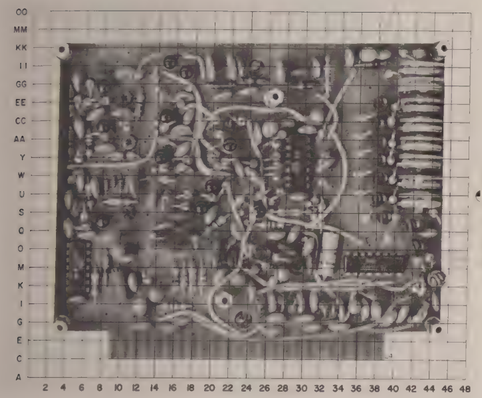


Figure 6-29. Parts Location, Assembly A15A5 (REV H).

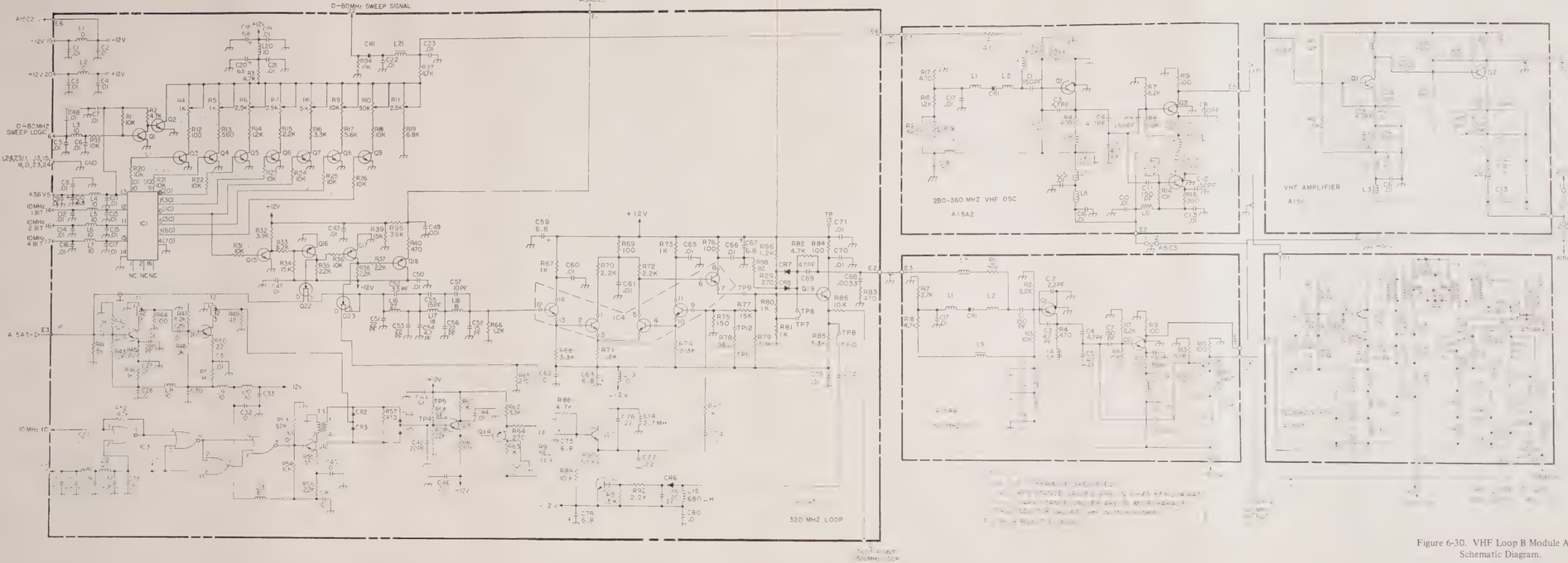


Figure 6-30. VHF Loop B Module A15, Schematic Diagram.

6.18 DISCRIMINATOR PC BOARD A16.

6.18.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Discriminator PC Board reference designator A16, unless otherwise specified.

Discriminator PC Board A16 carries two distinct circuits, a frequency discriminator used in the ± 5 MHz and 0–80 MHz SWEEP modes, and a phase detector with associated circuitry used when operating in the FM Mode.

Refer to the schematic diagram, figure 6-32. In the ± 5 MHz or 0–80 MHz SWEEP modes a square wave signal from the Mixer Divider PC Board A17 enters at pin 4. In the ± 5 MHz SWEEP mode the frequency is 4 ± 1 MHz and in the 0–80 MHz SWEEP mode it is within the range 0–80 MHz. The signal is buffered by gate 12-13-11 and then applied to pin 1 of IC1 and the input of 50 microsecond delay line DL1. The output of the delay line is applied to pin 9 of IC1. The waveform at pins 5 and 8 of IC2 is a negative going pulse 50 nanoseconds wide produced by performing the logical OR function on the waveform and its complement delayed by 50 nanoseconds. When two gates of the type in IC2 have their outputs connected together, the more positive level prevails, hence the logical OR function. This pulse on pin 10 of IC3 is inverted and appears as a positive pulse on the base of Q3, which together with Q4 forms a differential pair, with the common emitters feeding a current sink, consisting of Q1, Q2 and associated resistors. Q1 and Q2 are complementary transistors, thermally bonded and connected so that their base-emitter voltage variations with temperature cancel. The voltage developed across R7 thus appear across R9 and determines the current flowing into the collector of Q2. C2 prevents ripple on the −12V line from appearing across R7. The differential signals from the collectors of Q3 and Q4 are coupled by integrating networks R13, C5 and R14, C4 to Q5 and Q6. The collector of Q5 thus becomes more negative and this voltage is coupled by complementary emitter followers Q7 and Q8 to R24. The voltage at the emitter of Q8 varies linearly from +4V at zero frequency to −4V at 8 MHz.

The sweep voltage entering at pin 13 and the voltage at the emitter of Q8 are added algebraically at the non-inverting input of operational amplifier IC12. The gain of the latter is determined by R25 and R26. The output of IC12 is buffered by Q19, filtered by R29 and C10 before passing to output pin 22 via R32. The voltage at pin 22 controls the 300 MHz VCO when in the ± 5 MHz sweep mode. The signal on the emitter is also coupled through complementary emitter followers Q12 and Q13, with their associated low pass filters to pin 21. From here the signal controls the frequency of the 280–350 MHz oscillator on A15 when the RF-808 is in the 0–80 MHz SWEEP Mode.

Disabling of the sweep control signals is accomplished by Q10 and Q14. When pin 7 goes high Q10 is turned on and its collector holds pin 22 close to ground, thus disabling the ± 5 MHz feedback line. Similarly when pin 6 goes high, Q14 is turned on and its collector is held close to ground. Thus, the emitter of Q13 is also close to ground and the 0–80 MHz feedback line, pin 21 is disabled. The voltage on pin 21 varies from approximately +1 to +9 volts as the output of the generator sweeps from 0–80 MHz. For a ± 5 MHz sweep the voltage on pin 22 varies from approximately +5.3 to +6.9 volts.

The final output frequency of the generator is obtained by mixing a 270–280 MHz signal with a 280–350 MHz signal. If, during switch-on when in SWEEP mode or as a result of a transient, the output of the 280–350 MHz oscillator is lower in frequency than that of the 270–280 MHz oscillator, the feedback from the 0–80 MHz sweep loop will act such as to drive the frequency even lower, until a limiting condition is reached causing loop latch-up. In order to correct this a recovery circuit is included. In the limiting condition, the output of IC12 approaches -12 Volts. The negative excursion on the feedback lines is limited by the clipping action of CR3. The emitter of Q9 is pulled negatively through R19 and so turns on. The collector of Q9 falls to ground and via CR4 turns off Q15, which with Q16 forms a Schmitt trigger circuit' Q16 and hence Q11 turn on. The collector of Q11 approaches +12 volts, and through R36 and CR6 pulls the base of Q13 positive. This pulls the 0–80 MHz feedback line positive into its normal operating range. At the same time the base of Q15 is driven positively through CR5 and the Schmitt trigger is switched to its initial state. However, if the discriminator is still not operating in its linear region and the output of IC12 is still close to –12V, then as C19 discharges through R36, R41, R40 and R39, the voltage on the 0–80 MHz feedback line will decay towards ground until Q15 is turned off via CR5. The cycle then repeats for as long as IC12 remains negatively saturated. This recovery circuit limits the low frequency limit of the 0–80 MHz sweep to approximately 1 MHz.

With the sweep signal line, pin 13 held at ground potential, R6 sweep centering is adjusted to produce the correct generator output frequency. R88 sweep width is used to adjust the gain of the discriminator so that the output frequency sweep is ± 5 MHz or 0–80 MHz as the AUTO/MANUAL SWEEP control is rotated between its limits.

The FM section of the Discriminator PC Board Assembly contains a phase detector for control of the 20 MHz LC oscillator together with gating functions for the 20 MHz phase-locked and 20 MHz LC signals.

In the CW mode the FM logic line, pin 15 is low, enabling the 20 MHz phase locked signal on pin 9 to couple through gate 1-2-3 of IC4 to pin 4 of IC4. Pin 11 is low and so the 20 MHz phase locked signal couples through gate 4-5-6 and appears on pin 12, and then it is fed to the 300 MHz PLL.

In the SWEEP mode a low on pin 15 holds Q18 off, and relay K1 is de-energized. The high level on the cathode of CR7 is coupled to pins 10 and 12 of IC4 and the corresponding gates are disabled. With relay K1 de-energized, the sweep signal on pin 13 is coupled through R66 to pin 18 the control line for the 20 MHz LC oscillator, and this sweeps the frequency of the LC oscillator in the ± 50 and ± 500 kHz modes.

In the FM mode, the output of the 20 MHz LC oscillator is present on pin 11 and the 20 MHz and the 20 MHz reference signal is present on pin 9. This signal is derived from the 20 MHz phase-locked loop (PLL) except when in VERNIER mode, in which case it is provided by the 20 MHz VCXO on A11. A high on pin 15 puts a low on pins 3 and 4 of IC4, thus enabling the 20 MHz LC oscillator signal on pin 11 to pass through gate 4-5-6 to pin 12, and on to the 300 MHz PLL. At the same time Q18 is turned on, operating relay K1 and placing a low on pins 10 and 12 of IC4. The output of IC5 is then fed via R64 to pin 18, the LC Control Line, and signals on pins 11 and 9 are allowed to reach Q17 and Q20 respectively. The 20 MHz signal on the collector of Q17 is divided successively by 16, 16 and 8 in IC7, 8 and 11 respectively for an overall division ratio of 2048 at IC11, pin 11. Similarly the signal on the collector of Q20 is divided by 2048 at the output of IC10 pin 11. The outputs of the dividers at about a 10 kHz rate are AC-coupled to Q21 and Q22 with their collectors having a common load, R19. Each time the divider output goes high, the collector of Q21 and, therefore, pin 14 of IC11 go low. This is the trigger

input of a flip-flop whose output is on pin 12 of IC11. Thus the flip-flop is triggered into alternate states by the outputs of the dividers. The flip-flop switches transistor Q23. The values of R90, R77 and R78 are such that the voltage on the collector of Q23 is close to −0.6 volts when the waveform at IC11, pin 12 has a unity mark-space ratio. This voltage is filtered by R78 through R82 and C31 through C34, to remove the 10 kHz (approx) component and then applied to IC5 via emitter follower Q24. Resistors R84, R85, R91 and R62 determine the voltage gain of the operational amplifier IC5; this is approximately 2 for the phase detector output and 4 for the FM input from A16, pin 16. The output of IC5 becomes the frequency control signal for the 20 MHz voltage controlled LC oscillator. With no signal on the FM input line the 20 MHz VCO is locked to the 20 MHz phase-locked signal (or the 20 MHz VCXO signal when in VERNIER mode) through the action of the phase detector just described. When modulation is applied, the voltage variation on the LC control line modulates the frequency of the 20 MHz LC oscillator and hence that of the generator output. However, the response time of the loop is too long to follow the modulating frequency and the loop maintains the mean frequency of the 20 MHz LC oscillator at 20 MHz.

6.18.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position prior to removing board A16 from the RF-808.

a. Remove Printed Circuit Board A16 (paragraph 5.3.9). Extend board A16 from main frame using Extender Board 808-0170. Refer to figure 6-31.

b. Set RF-808 to 40,000 kHz in the ± 5 MHz MANUAL SWEEP mode. Depress the +20 dBm button and set the output level to 2 volts. Connect a frequency counter to the RF OUTPUT connector, through a 50 ohm termination.

c. Connect a DVM to the Sweep Buffer PC Board output (top of A3R5). Adjust the MANUAL SWEEP control to give a reading of .0000 ± .0005 volts.

d. Adjust A16R6 to give an output frequency reading of 40,000 kHz ± 25 kHz.

e. Adjust A16R88 so that the output frequency changes by ± 5 MHz ± 50 kHz) when the MANUAL SWEEP control is set to +5 and −5 respectively.

f. Set the RF-808 to give 200 mV rms out at 5.000 MHz when terminated with 50 ohms. Set the FM DEVIATION to 15 kHz and depress the CW button. Connect a spectrum analyzer (HP8553B/8552B) to the 50 ohm output termination. Center the carrier on the screen.

g. Depress the FM button and rotate the MOD LEVEL control fully clockwise. Connect an external audio oscillator to the MOD IN/OUT connector, and adjust its output frequency monitored on a frequency meter to 2717 Hz ± 1 Hz, and its output level to give a reading of ± 15 kHz on the MOD LEVEL meter.

h. Depress the CW button and note the full screen deflection of the carrier.

i. Depress the FM button and adjust A16R91 for a carrier null of greater than −40 dB.

6.18.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronic Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend the Discriminator PC Board A16 from the RF-808 main frame. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Where conditions are not specified, the RF-808 control settings and mode of operation will not effect the resultant data. Refer to figure for test points and component locations and figure for the assembly schematic diagram.

TABLE 6-35. A16 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	−3.5	−4.2	−12.0	
Q2	−4.1	−3.5	−2.2	
Q3	−1.8	−1.4	+8.6	
Q4	−1.8	−1.1	+6.1	
Q5	+6.7	+6.1	−0.1	
Q6	+9.3	+8.6	0	± 5 MHz MANUAL SWEEP mode. SWEEP control set to 0.
Q7	+0.6	−0.1	−12.0	
Q8	+0.1	+0.6	+12.0	
Q9	+3.0	0	+4.4	
Q10	0	−1.5	+6.1	
Q11	+12.0	+12.0	0	
Q12	+8.5	+7.9	−12.0	
Q13	−0.6	0	+12.0	
Q14	0	+0.7	0	
Q15	+3.1	+3.8	+3.1	
Q16	+3.1	+3.1	+12.0	
Q17	−5.1	−4.4	−3.4	
Q18	0	+0.7	+0.1	FM mode
Q20	−5.1	−4.3	−3.5	
Q21	−5.1	−5.1	−0.1	
Q22	−5.1	−5.1	−0.1	
Q23	0	−0.2	−0.6	
Q24	0	−0.6	−5.0	

TABLE 6-36. A16 INTEGRATED CIRCUIT DC VOLTAGE CHART
(Voltages are nominal unless otherwise specified)

REF DESIG	PIN													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
*IC5	0	0	+8.1	0	0	−12.0	−12.0	0	−11.2	−0.6	+12.0	+8.8	0	0
**IC12	0	0	+8.2	+.03	+.03	−12.0	−12.0	0	−11.4	+8.5	+12.0	+8.6	0	0

* FM mode
** ± 5 MHz SWEEP mode, SWEEP control set to 0.

TABLE 6-37. A16 CONNECTOR PIN VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)	REMARKS
Connector Pin		
2	–	
3	−5.2	
4	−1.6	± 5 MHz MANUAL SWEEP mode SWEEP control set to 0.
5	0	
6	−0.4	± 5 MHz MANUAL SWEEP mode SWEEP control set to 0.
7	−0.2	± 5 MHz MANUAL SWEEP mode SWEEP control set to 0.
8	–	
9	−1.1	
10	–	
11	−1.1	FM mode
12	−1.2	FM mode
13	−10.4	± 5 MHz MANUAL SWEEP mode SWEEP control set to 0.
14	0	
15	+3.6	FM mode
16	0	FM mode
17	0	
18	+3.0	FM mode
19	−12.0	
20	+12.0	
21	−0.6	± 5 MHz MANUAL SWEEP mode SWEEP control set to 0.
22	0	
23	0	

TABLE 6-38. A16 WAVEFORM CHART

REF DESIG	WAVEFORM	REMARKS
Connector Pin		
4	900 mV p-p square wave. Frequency varies with MAN SWEEP control from 3,020 to 5,020 kHz.	MAN SWEEP ± 5 MHz
	900 mV p-p square wave. Frequency varies with MAN SWEEP control from less than 200 kHz to more than 9 MHz	MAN SWEEP 0–80 MHz
	–1.7 VDC	0 THER MANUAL SWEEP modes
9	20 MHz 850 mV p-p	
11	20 MHz 1.0V p-p	FM mode
	20 MHz ± 50 kHz as MAN SWEEP control rotated.	MAN SWEEP ± 50 kHz
	20 MHz ± 500 kHz as MAN SWEEP control rotated.	MAN SWEEP ± 500 kHz
	–1.6 VDC	CW, AM & PULSE modes
12	20 MHz ± SWEEP RANGE selected 700 mV p-p	MAN SWEEP, except ± 5 MHz and 0–80 MHz
	–0.7 VDC	MAN SWEEP ± 5 MHz and 0–80 MHz
	20.000 000 to 20.001 000 MHz as VERNIER control is rotated	VERNIER
	Swept frequency 20 MHz ± SWEEP range selected	AUTO SWEEP except ± 5 MHz and 0–80 MHz
16	30 mV p-p @ 1 kHz or 400 Hz	FM mode 5 kHz DEV
	90 mV p-p @ 1 kHz or 400 Hz	FM mode 15 kHz DEV
	450 mV p-p @ 1 kHz or 400 Hz	FM mode 75 kHz DEV
	2.25V p-p @ 1 kHz or 400 Hz	FM mode 375 kHz DEV
		All with MOD LEVEL control fully CW.
21	+0.9 to +10.0 VDC as SWEEP control is rotated. Below 0.9V inverted sawtooth 5V p-p from 1.0 VDC level. Period approx. 150 milliseconds.	MAN SWEEP 0–80 MHz
	–0.5 VDC	Other modes
22	Sawtooth 1.5V p-p from 6.0 VDC level Frequency varies with RATE controls	AUTO SWEEP ± 5 MHz

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PARTS LOCATION GUIDE FOR FIGURE 6-31, ASSEMBLY A16

A16

REF DESIG	LOCATION
C1	HH,9
C2	Z,26
C3	JJ,30
C4	JJ,37
C5	HH,37
C6	EE,29
C7	CC,37
C8	X,35
C9	U,29
C10	M,33
C11	Q,35
C12	R,37
C13	X,38
C14	V,38
C15	R,39
C16	P,39
C17	K,38
C19	O,36
C20	N,9
C21	L,5
C22	O,6
C23	P,2
C24	W,5
C25	Q,17
C26	Z,16
C27	R,17
C28	O,21
C29	L,19
C30	DD,15
C31	CC,20
C32	DD,22
C33	AA,20
C34	Z,19
C35	GG,18
C36	Z,9
C37	U,2
C38	CC,9
CR1	AA,36
CR2	BB,38
CR3	O,31
CR4	R,23
CR5	R,22
CR6	I,36
CR7	N,27
DL1	KK,14
IC1	DD,6
IC2	GG,15
IC3	GG,22
IC4	L,12
IC5	R,19
IC6	T,5
IC7	T,8
IC8	T,11
IC9	AA,6
IC10	Z,12
IC11	T,15
IC12	X,31
K1	J,23
L1	GG,27
L2	Y,4
L3	J,4
L4	K,3
L5	HH,2
Q1	BB,26
Q2	DD,26
Q3	II,29
Q4	HH,31
Q5	HH,34
Q6	FF,35
Q7	BB,32
Q8	DD,32
Q9	N,30
Q10	I,34
Q11	K,31
Q12	U,35
Q13	K,35
Q14	M,38
Q15	T,25
Q16	R,25
Q17	O,7
Q18	L,25
Q20	o,4
Q21	K,6
Q22	L,10
Q23	BB,16
Q24	X,18
R1	GG,6
R2	II,4
R3	II,7
R4	FF,7
R5	EE,24
R6	Z,22
R7	BB,25
R8	CC,25
R9	AA,27
R10	JJ,32
R11	II,34
R12	II,28
R13	JJ,35
R14	II,35
R15	EE,23
R16	GG,32
R17	FF,33
R18	AA,30
R19	S,27
R20	DD,28
R21	BB,29
R22	DD,30
R23	BB,33
R24	CC,34
R25	Z,38
R26	U,32
R27	Z,32
R28	P,34
R29	O,32
R30	O,33
R31	K,29
R32	J,33
R33	S,34
R34	Y,36
R35	W,37
R36	L,32
R37	I,38
R38	T,36
R39	T,37
R40	P,37
R41	N,37
R42	J,32
R43	N,36
R44	J,37
R45	L,15
R46	I,15
R47	M,21
R48	O,15
R49	R,26
R50	Q,23
R51	O,24
R52	Q,25
R53	V,23
R54	M,34
R55	V,26
R56	V,18
R57	Z,17
R58	N,8
R59	P,9
R60	N,5
R61	N,3
R62	U,21
R63	N,19
R64	M,17
R65	Q,28
R66	K,18
R67	L,23
R68	DD,11
R69	P.12
R70	I,33
R71	Z,15
R72	L,8
R73	S,31
R74	FF,4
R75	J,8
R76	Z,11
R77	AA,17
R78	BB,18
R79	EE,20
R80	BB,21
R81	Z,21
R82	Y,20
R83	W,21
R84	U,16
R85	W,19
R86	O,16
R87	BB,35
R88	FF,37
R89	GG,10
R90	AA,19
R91	Y,26
R92	U,38

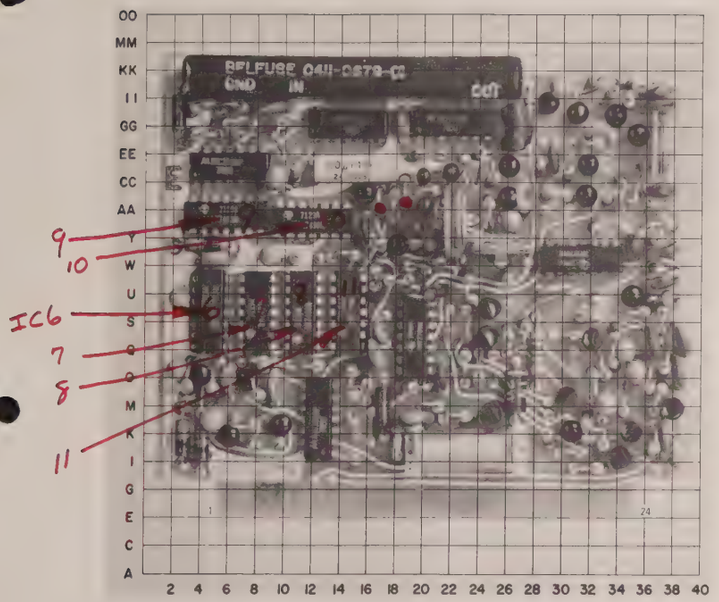


Figure 6-31. Parts Location, Assembly A16 (REV G).

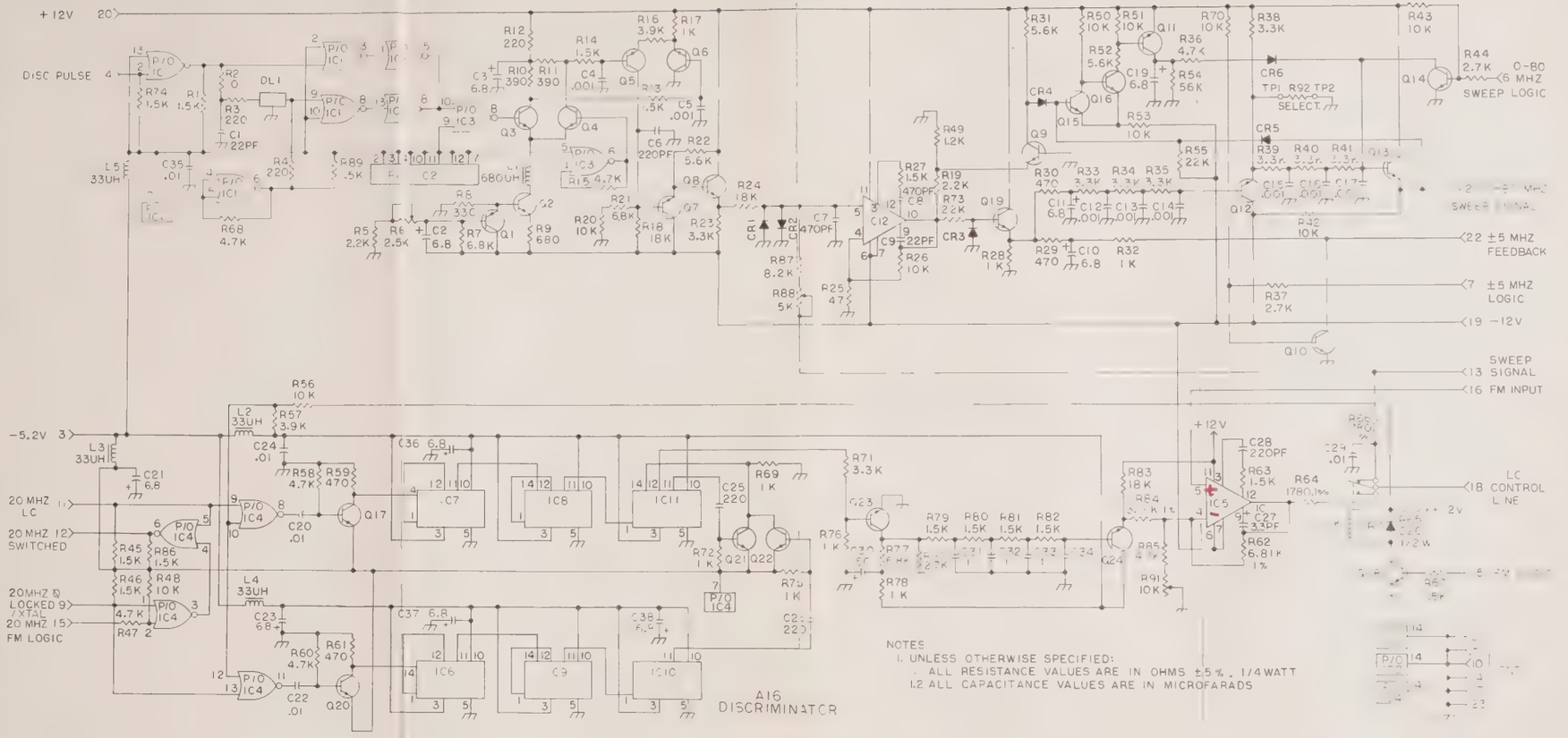


Figure 6-32. Discriminator PC Board A16, Schematic Diagram.

6.19 MIXER/DIVIDER PC BOARD A17.

6.19.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Mixer/Divider PC board reference designator A17, unless otherwise specified.

Mixer Divider PC Board A17 is used as part of the sweep circuitry when the RF-808 is in the 0–80 MHz and ± 5 MHz modes.

Refer to schematic diagram figure 6-35. The tens MHz front panel control does not pretune the 280–350 MHz oscillator when operating in the 0–80 MHz SWEEP mode (see paragraph 6-17). The frequency is controlled instead by the MANUAL SWEEP CONTROL on the front panel. The 280–350 MHz signal enters at E1, is amplified by Q5 in grounded base configuration, and drives the emitter of Q1 through R29. In a similar way, the 270–280 MHz input on E2, drives the emitter of Q1 via R10. The two signals are mixed in Q1 and the mixer products are amplified in Q2. L6 and C4 attenuate the high-frequency components and the difference signal of 1–80 MHz is further amplified in Q4 and Q3 which together form a feedback amplifier with a voltage gain of approximately 2. The signal on the collector of Q3 is fed via C16 and R9 to pin 22 and from there to the RF UNCAL connector on the rear panel of the instrument. In the 0–80 MHz sweep mode, the level on pin 6 is logic 0 and this enables gate 10-12-8 of IC1. The 1–80 MHz is amplified by this gate and squared by gate 5-6 of IC1. It then triggers flip-flop IC2 to give a signal on pin 1 of IC2 of half the input frequency. This signal passes through IC3 to pin 9 and then to a divide by five circuit consisting of IC4, IC5, IC6 and IC7. The signal on pin 1 of IC5 is a square wave with a period one fifth of that on IC3 pin 9, and this 0–80 MHz signal becomes the input to the discriminator through pin 4.

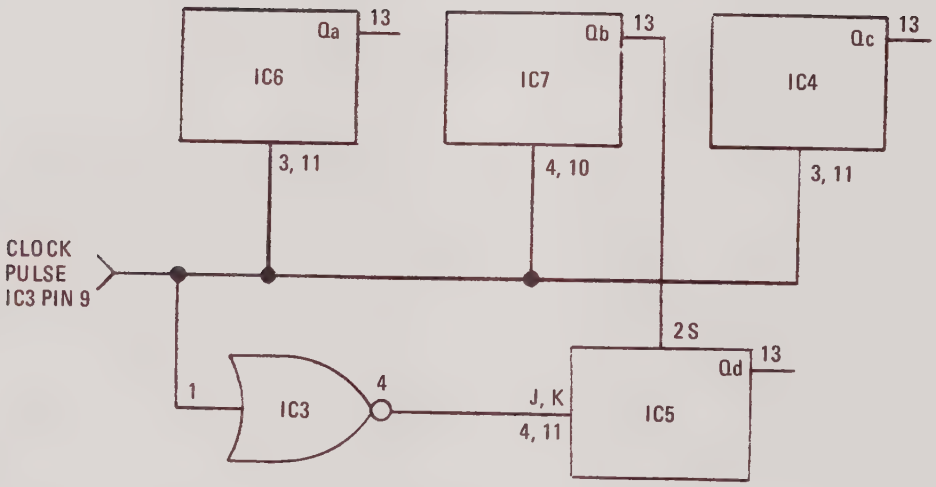
In the ± 5 MHz sweep mode, pin 6 is high disabling IC1 gate 12-10-8 and setting IC2 to give a low on pin 1 of IC2. Pin 7, the ± 5 MHz logic line, is low, enabling the 20 ± 5 MHz signal on pin 9 to pass through gates 10-11-12 and 5-6-8-9 of IC3. It is then divided by 5 as before and appears as a 4 ± 1 MHz output on pin 4.

The sequence for the divider circuit is shown in figure 6-33.

6.19.2 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronic Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.



CLOCK PULSE PULSE	Qa	Qb	Qc	Qd
1	0	0	0	0
2	1	0	0	0
3	0	1	0	1*
4	1	1	0	1
5	0	0	1	1
6	0	0	0	0

*Initiated by transition of Qb from 0 to 1

Figure 6-33. Divider Sequence A17

Remove A17/A18 from RF-808. Use an extender cable to connect Mixer/Divider PC Board A17 connector to RF-808 connector XA17. Set the RF-808 controls to obtain the conditions specified in the Remarks column. Where conditions are not specified, the RF-808 control settings and mode of operation will not affect the resultant data. Refer to figure for test points and component locations and figure for the assembly schematic diagram.

TABLE 6-39. A17 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	−0.8	0	+5.4	RF-808 controls may be set for any mode of operation
Q2	+4.8	+5.4	+10.4	
Q3	+4.3	+5.1	+7.1	
Q4	0	+0.6	+5.1	
Q5	−0.8	0	+5.7	
Q6	−0.8	0	+5.7	

TABLE 6-40. A17 TEST POINT VOLTAGE CHART

TEST POINT	VOLTS DC (NOMINAL)	REMARKS
TP1	10.4	RF-808 controls may be set for any mode of operation
TP2	−0.8	

TABLE 6-41. A17 WAVEFORM CHART

REF DESIG	WAVEFORM	REMARKS
Connector Pin		
4	900 mV p-p square wave. Frequency varies with MAN SWEEP control from 3,020 to 5,020 kHz.	MAN SWEEP ± 5 MHz
	900 mV p-p square wave. Frequency varies with MAN SWEEP control from less than 200 kHz to more than 9 MHz.	MAN SWEEP 0–80 MHz
	−1.7 VDC	OTHER MANUAL SWEEP modes.
9	20.000 000 to 20.001 000 MHz as VERNIER control is rotated, 275 mV p-p	VERNIER SWEEP mode
	20 MHz ± SWEEP range selected as MANUAL SWEEP control is varied, 275 mV p-p.	MAN SWEEP except 0–80 MHz range
	Swept frequency 20 MHz ± SWEEP RANGE selected, 275 mV p-p.	AUTO SWEEP mode
22	100 to 300 mV into 50 ohm load. Frequency as set on front panel.	

PARTS LOCATION GUIDE FOR FIGURE 6-34, ASSEMBLY A17

A17

REF DESIG	LOCATION
C1	M,34
C2	S,34
C3	Z,36
C4	Y,36
C5	Y,28
C6	Q,15
C7	O,34
C8	O,24
C9	Y,2
C10	CC,36
C11	Z,34
C12	CC,29
C13	J,18
C14	W,28
C15	DD,14
C16	DD,24
C17	II,14
C18	AA,20
C19	V,24
C20	Z,25
C21	Y,22
C22	Z,16
C23	U,8
C24	U,5
C25	V,7
C26	EE,4
C27	L,9
C28	R,20
C29	J,22
C30	N,16
C31	L,24
C32	M,20
C33	J,33
C34	P,20
C35	N,29
C36	FF,36
C37	R,32
CR1	R,5
IC1	Y,20
IC2	Y,14
IC3	Y,7
IC4	GG,17
IC5	N,8
IC6	GG,7
IC7	GG,12
L1	K,32
L2	U,35
L3	P,31
L4	U,31
L5	R,29
L6	X,33
L7	R,11
L8	S,8
L9	II,19
L10	S,20
L11	O,3
L12	FF,3
L13	V,17
L14	K,23
L15	L,17
L16	J,27
Q1	V,29
Q2	Y,31
Q3	BB,28
Q4	CC,34
Q5	L,21
Q6	O,17
R1	I,24
R2	L,15
R3	Q,36
R4	AA,30
R6	W,32
R7	U,30
R8	GG,35
R9	JJ,25
R10	S,26
R11	AA,36
R12	HH,32
R13	II,28
R14	FF,29
R15	DD,30
R16	DD,32
R17	N,18
R18	J,30
R19	AA,26
R20	X,25
R21	V,22
R22	T,4
R23	W,3
R24	Z,3
R25	Q,6
R26	DD,9
R27	CC,10
R28	AA,11
R29	Q,28
R30	M,25
R31	J,29
T1	N,22
T2	Q,17
Test Points	
TP1	X,34
TP2	T,28
TP3	W,22
TP4	GG,9
TP5	R,10

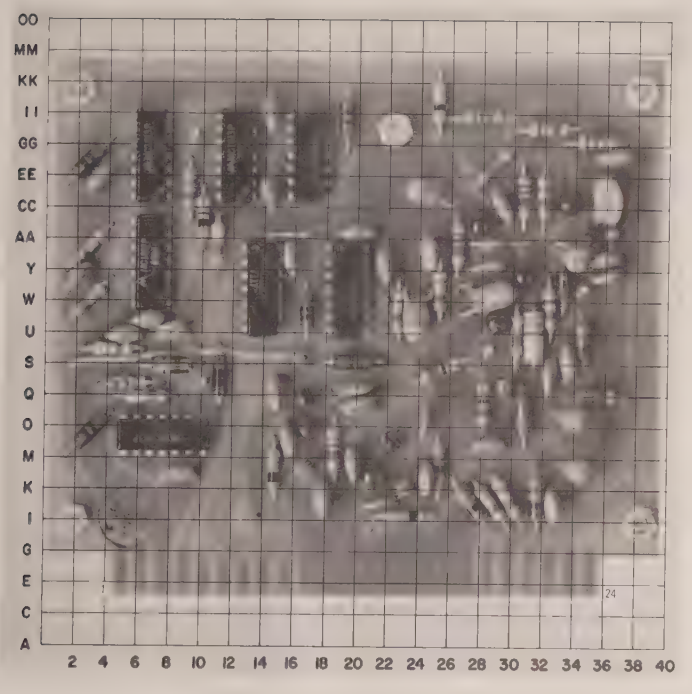


Figure 6-34. Parts Location, Assembly A17 (REV K).

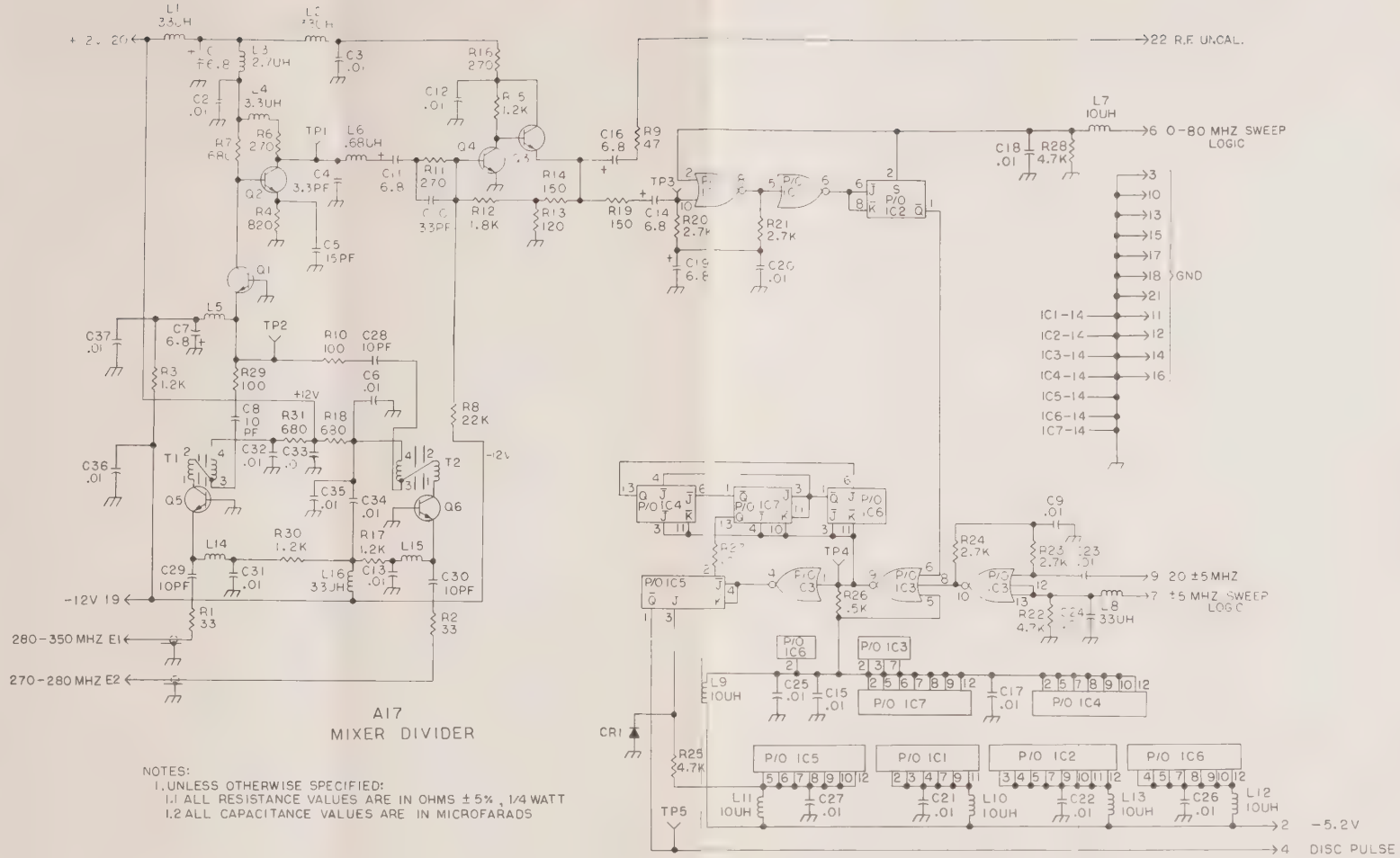


Figure 6-35. Mixer/Divider PC Board A17. Schematic Diagram.

6.20 AM OUTPUT LOOPS PC BOARD A18.

6.20.1 Circuit Description.

NOTE

Prefix all AM Output Loop PC Board reference designators with reference designator A18, unless otherwise specified.

Before mixing the 270–280 MHz and the 280–350 MHz signals to produce the generator output frequency, the 270–280 MHz signal is first passed through an amplitude modulator and a level shifter. The amplitude modulator is part of a closed loop in which the detected output of the modulator is compared with the signal from the VARIABLE LEVEL control. The amplified error signal is then used to control the modulator. The level shifter is controlled by the output of an error amplifier, in which the signals being compared are the detected signal from the Output Amplifier Module A19 and the signal from the VARIABLE LEVEL control.

Refer to schematic diagram , figure 6-37. The 270–280 MHz signal on J1 is amplified by common emitter amplifier Q5 and then coupled by T5 to the base of Q6, which together with R7 forms a differential amplifier. The output of Q7 is coupled by C32 to the peak detector consisting of CR10 and C33. CR10 is forward biased by the small current through R38 to improve linearity. The negative voltage developed across C33 is applied to one end of the potential divider R36 and R18. The positive voltage from the VARIABLE LEVEL control enters at pin 4, and is buffered by complementary emitter followers Q1 and Q2 before being applied via CR6 to the other end of the potential divider. The voltage at the junction of R18 and R36 is applied to the non-inverting input of operational amplifier, IC2, whose voltage gain is determined by R23 and R24. The output of IC5 is level shifted by CR7 and then applied to the base of Q4, the current source for Q6 and Q7. As the voltage on the base of Q4 varies, so does the current flowing through Q4 and the differential pair Q6 and Q7. In this way the gain of the differential amplifier is controlled. The loop operates such that at a given setting of the VARIABLE LEVEL control, the output of Q7 is maintained at a level where the detected signal balances that from the VARIABLE LEVEL control to produce a constant input voltage on pin 5 of IC2. The offset control R20 is used to set the minimum RF output from the collector of Q7. CR7 allows the output of IC2 to operate close to ground while the base of Q4 is close to –12 volts. CR9 limits the positive excursion on the base of Q4 and hence the current through Q6 and Q7. CR8 prevents Q4 from saturating.

The RF signal from Q7 is applied to gate 1 of Q8. The output of Q8 passes through the 500 MHz low-pass filter L12, C39 through C43, through T4 and T3 to mixer diodes CR11 through CR14. The 280–350 MHz signal enters at J2 and passes through T1 and T2 to the mixer diodes. The 0–80 MHz output of the mixer passes through low-pass filter L13, L14, L15, C44, C45 and C46 to pin 13.

The negative signal from the detector in the Output Amplifier Module A19 enters at pin 3, and has a source impedance of approximately 10,000 ohms. This added algebraically to the positive signal from the VARIABLE LEVEL control on the emitter of Q2. The sum signal is applied to the non-inverting input of IC1, whose voltage gain is determined by R7, R9 and R10. The output of IC1, after attenuation by R11, R12, R14 and R37 is applied to gate 2 of Q8 and thus controls the gain to the signal on gate 1, and subsequently the signal from the detector on the Output Amplifier Module A19. The output loop operates such that at a given setting of the

VARIABLE LEVEL control, the detector output is maintained at a level where it balances that from the VARIABLE LEVEL control to produce a constant input voltage on pin 5 of IC1. The offset control, R6 is used to compensate for tolerances in the Output Amplifier detector and the voltage offsets of IC1.

In the PULSE MODULATION mode the output loop is disabled by a positive level on pin 2, which is normally open circuit. Q3 then turns on, and the collector is held at a fixed positive potential set by R16 and R41. This fixes the potential on gate 2 of Q8 and hence its gain.

6.20.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in OFF position prior to removing the AM Output Loops PC Board A18 from the RF-808.

a. Remove printed circuit board A18 (paragraph 5.3.9). Extend board A18 from main frame using Extender Cable 808-0356. Initiate turn-on procedures (paragraph 3.3).

b. Set the RF-808 for a CW output of 5.000 MHz. Depress the 0 dBm button and set the VARIABLE LEVEL control for 0 dBm output. Connect the RF OUTPUT to the HP Spectrum Analyzer and obtain a full screen presentation.

c. Rotate the VARIABLE LEVEL control fully CCW. Adjust A18R20 (figure 6-36) for a minimum output level as viewed on the HP Spectrum Analyzer. Then set A18R20 for an output level 1 dB above this minimum.

d. Adjust A18R6 for a minimum output level as viewed on the HP Spectrum Analyzer. Then set A18R6 for an output level 1 dB above this minimum.

e. Repeat steps c and d.

f. Set the RF-808 to give an output at 50 kHz in the PULSE mode at 0 dBm. Apply +3 volts to the MOD IN/OUT connector. Observe the OUTPUT LEVEL meter as the frequency is changed according to the table. Note the frequency at which the output is a minimum f min.

kHz
50
1050
2050
3050
4050
5050
6050
7050
8050

kHz
9050
10050
20050
30050
40050
50050
60050
70050
79050

g. Set the RF-808 to f min. Connect a HP 91H RF Voltmeter through a 20 dB pad (2W rating) to the RF OUTPUT connector. Set the +30 dBm switch to ON and depress the +30 dBm button. Adjust A18R16 to give an output reading of 1.05V on the HP 91H RF Voltmeter.

6.20.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

Remove A17/A18 from RF-808. Use an extender cable to connect AM/Output Loops PC Board A18 connector to RF-808 connector XA18. Set the RF-808 controls to obtain the conditions specified in the REMARKS column. Where conditions are not specified, the RF-808 control settings and mode of operation will not effect the resultant data. Refer to figure 6-36 for test points and component locations and figure 6-37 for the assembly schematic diagram.

TABLE 6-42. A18 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	+0.6 to +3.7	0 to +3.1	−12.0	Emitters and base voltages vary in accordance with setting of VARIABLE LEVEL control.
Q2	0 to +3.1	+0.6 to +3.7	+12.0	Emitters and base voltages vary in accordance with setting of VARIABLE LEVEL control.
Q3	−12.0	−12.0	−0.5	CW mode
Q3	−7.6	−7.0	+1.5	PULSE mode
Q4	−11.4 to −7.6	−10.8 to −7.3	−1.8 to −7.3	Varies with setting of VARIABLE LEVEL control
Q5	−7.2	−6.4	0	
Q6	−0.7	0	+12.0	
Q7	−0.7	0	+12.0	
Q8 FET	0 (Source)	0 (Gate 1) * (Gate 2)	+12.0 (Drain)	*In CW mode Gate 2 is −0.5 In PULSE mode Gate 2 is +1.5

TABLE 6-43. A18 INTEGRATED CIRCUIT DC VOLTAGE CHART
(Voltages are nominal unless otherwise specified)

REF DESIG	PIN 1	2	3	4	5	6	7	8	9	10	11	12	13	14
*IC1	–	–	–	0 to +0.1	0 to +0.6	–12.0	–12.0	–	–	–0.1 +11	+12.0	–	–	–
*IC2	–	–	–	+0.05 +0.14	+0.05 +1.3	–12.0	–12.0	–	–	–1.9 +6.7	+12.0	–	–	–
*Voltages vary with setting of VARIABLE LEVEL control.														

TABLE 6-44. A18 TEST POINT VOLTAGE CHART

TEST POINT	VOLTS DC	REMARKS
TP1	–11.4 to –7.6	Varies with setting of VARIABLE LEVEL control

TABLE 6-45. A18 WAVEFORM CHART

REF DESIG	WAVEFORM	REMARKS
Connector Pin 13	50 mV p-p at frequency selected on front panel. Amplitude varies with OUTPUT LEVEL control	All modes except PULSE
	80 mV p-p at frequency selected on front panel.	PULSE mode

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PARTS LOCATION GUIDE FOR FIGURE 6-36, ASSEMBLY A18

A18

REF DESIG	LOCATION
C1	CC,4
C2	FF,3
C3	CC,6
C4	EE,7
C5	AA,15
C6	CC,15
C7	Z,4
C8	EE,12
C9	FF,15
C11	HH,20
C12	FF,18
C13	LL,11
C14	MM,33
C15	II,39
C16	II,35
C17	GG,22
C18	CC,37
C19	II,23
C20	EE,22
C21	Y,3
C22	CC,2
C23	Z,36
C24	L,27
C25	L,25
C26	J,27
C27	O,27
C28	P,25
C29	R,30
C30	Q,32
C31	Q,33
C32	U,32
C33	X,33
C34	U,24
C36	AA,30
C37	Z,27
C38	W,24
C39	T,19
C40	T,15
C41	T,11
C42	T,7
C43	U,4
C44	K,10
C45	K,16
C46	L,20
C47	AA,35
C48	AA,28
C49	FF,35
CR1	HH,6
CR2	KK,4
CR3	II,9
CR4	GG,9
CR5	LL,20
CR6	FF,38
CR7	DD,36
CR8	DD,28
CR9	EE,32
CR10	W,33
CR11	O,2
CR12	O,3
CR13	O,4
CR14	O,5
IC1	II,12
IC2	II,33
L1	AA,13
L2	BB,1
L3	X,37
L4	O,34
L5	I,25
L7	T,36
L8	U,33
L10	X,25
L11	Y,29
L12	U6 thru U22
L13	M,9
L14	N,13
L15	N,19
Q1	FF,5
Q2	HH,5
Q3	JJ,19
Q4	EE,25
Q5	N,27
Q6	P,31
Q7	S,31
Q8	V,26
R1	BB,3
R2	II,4
R3	GG,6
R4	II,7
R5	KK,8
R6	AA,8
R7	EE,9
R8	GG,10
R9	CC,13
R10	II,18
R11	HH,16
R12	KK,16
R13	II,21
R14	KK,17
R15	HH,21
R16	AA,18
R17	EE,19
R18	GG,36
R19	FF,37
R20	II,28
R21	FF,29
R22	II,30
R23	FF,30
R24	GG,34
R25	EE,38
R26	DD,31
R27	EE,23
R28	Z,5
R29	J,29
R30	M,30
R31	K,33
R32	K,25
R33	M,24
R34	P,29
R35	S,28
R36	Y,35
R37	T,25
R38	V,36
R39	V,29
R40	U,30
R41	AA,22
R42	K,4
R43	R,26
T1	L,3
T2	M,3
T3	P,4
T4	R,3
T5	N,30

Test Points	
TP1	DD,26
TP2	CC,22
TP3	Y,22

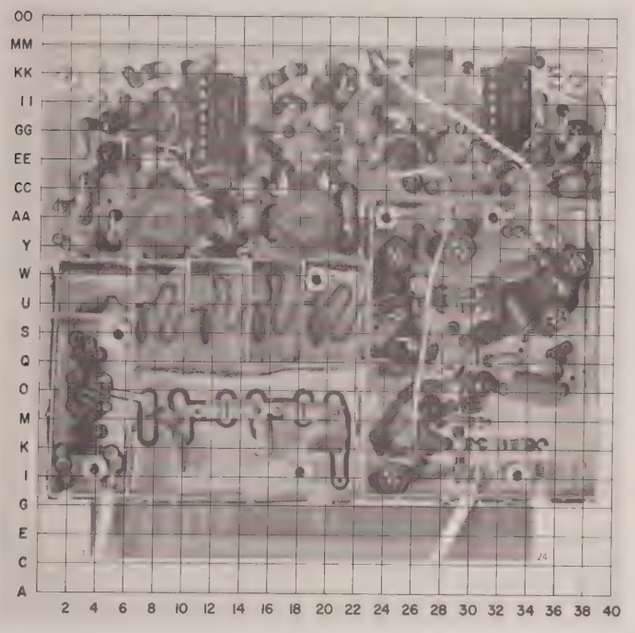


Figure 6-36. Parts Location, Assembly A18 (REV K).

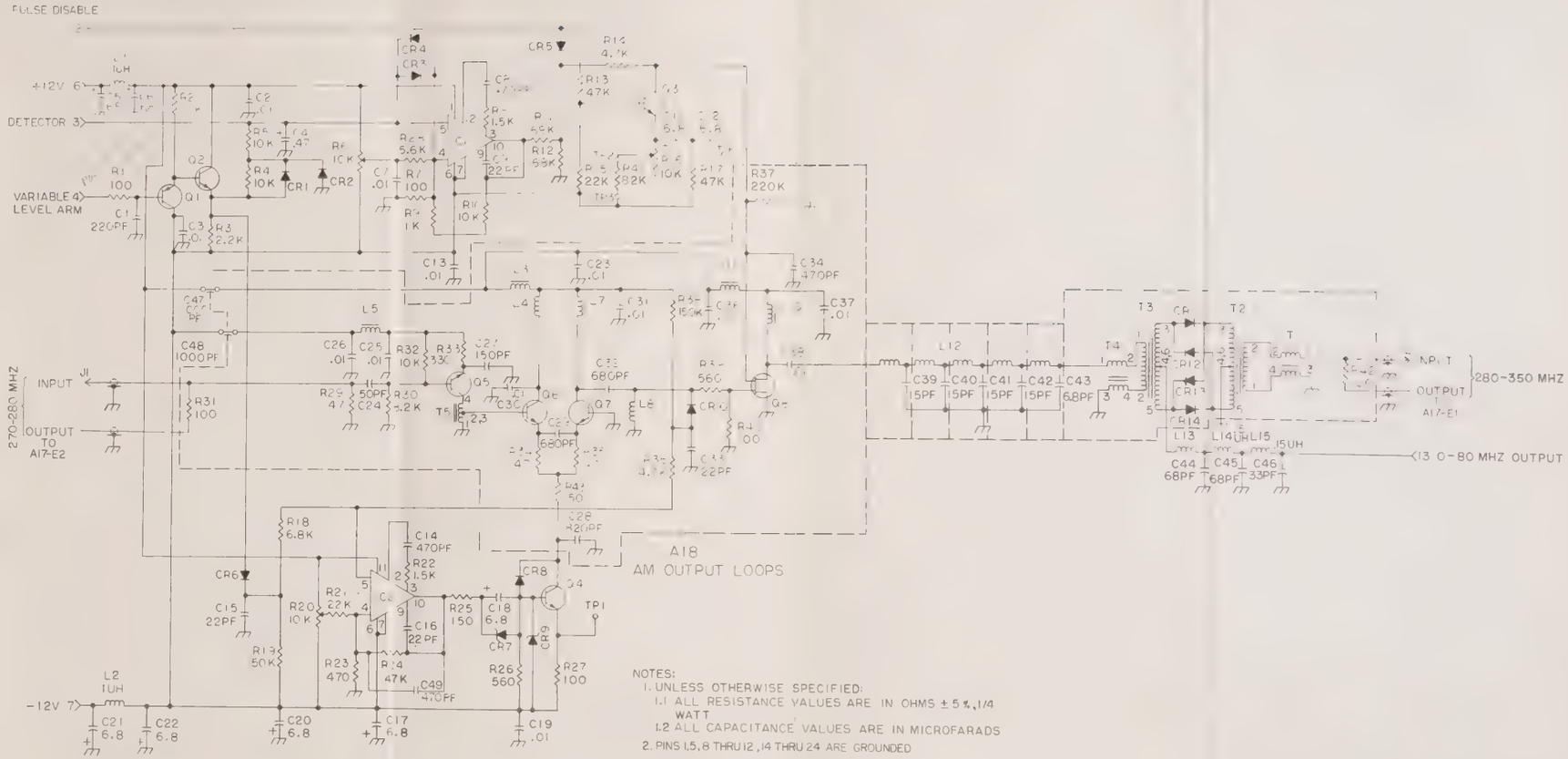


Figure 6-37. AM Output Loops PC Board A18, Schematic Diagram.

6.21 OUTPUT AMPLIFIER MODULE A19.

6.21.1 Circuit Description.

NOTE

Prefix all output amplifier module reference designators with Output Amplifier Module reference designator A19, unless otherwise specified.

Output Amplifier Module A19 raises the amplitude of the input frequency to the 10 volt level. It also contains the pulse modulator and leveling detector. Refer to the schematic diagram figure 6-40. The signal from the output mixer on A18 enters the module at pin 3 and is amplified in differential amplifier Q5, Q6. The signal from Q6 is buffered in Q7 to provide a low impedance drive to T1. Resistors R14 and R19 fix the voltage gain at approximately 9. When not in PULSE mode, pin 11 is at +12V and pin 8 is open circuited. Q14 and Q13 are off, and current flows through R39, R37 the windings of T1 and T2 and then through CR1, 2, 7 and 8 to ground. Thus the secondary of T1 is effectively connected to the primary of T2 through this matched diode quad gate. At the same time, CR3, CR4, CR5 and CR6 are reverse-biased. The signal from the secondary of T2 is amplified in the differential amplifier Q7, Q8 and appears at low impedance from the emitter of Q2. From here the signal is AC-coupled to emitter follower Q9 which drives parallel-connected emitter-followers Q4 and Q10. Q4 and Q10 drive the output amplifier stage Q3 via R12, C9 and R28, C18 respectively. The forward bias for Q9, Q4, Q10 and Q3 is provided by the voltage drop across R38, R33, CR9, CR16 and CR17. If fault conditions bring about an increase in the average current flowing in Q3, a point will be reached where the voltage at its emitter is sufficient to turn on Q16 via R34 and R35. Q16 will then present a low impedance to the signal at the base of Q7, and the drive to Q3 will be reduced. This will counteract the rise in the mean current through Q3. Thus protecting the output stage. The output from the collector of Q3 is fed through high-frequency peaking components L6 and C26, to the parallel combination of R45 and R46 and then to J1, the output connector to Attenuator Assembly A12. When the +30 DBM OUTPUT LEVEL is required, pin 17 is high and Q15 turns on to energize relay K1, closing the contact to shorts out R45 and R46.

When operating in PULSE mode, pin 8 is connected to the pulse input line. A position pulse of greater than +1.5V switches Q14 on. When Q14 is on, Q13 turns on, and current flows from its collector through R37, R39 and L1 to pin 11, which is now fixed at −5.2 volts. Current also flows through CR1, CR2, CR7 and CR8 to ground, and the signal in T1 is allowed to pass to T2. When Q14 is off, Q13 is off, and current flows through CR3, CR4, CR5, CR6, R37 and R39 to pin 11. At the same time CR1, CR2, CR7 and CR8 are reverse biased, the signal on T1 is prevented from reaching T2 and the generator output signal is interrupted.

The signal from the collector of Q3 is detected by CR10 and CR11. The negative voltage developed at the anode of CR11 is filtered by R43 and C27, and appears as an output on pin 19, which is used to drive the OUTPUT LEVEL meter on the front panel. The detector signal on pin 14 is derived in a similar manner and is the feedback signal to the AM Output Loop on Printed Circuit Board A18. The parallel combination of R45 and R46 set the Amplifier Output impedance to 50 ohms. after the leveling detector.

Q12 is normally held on by the voltage on pin 6 providing base current through R41. With Q12 on, Q11 is off and the circuit behaves normally. The +6.3 volts on pin 6 is supplied via contacts on Attenuator Assembly A12. When this board is removed, pin 6 is open circuited and Q12 turns off. Q11 turns on, with base current supplied by R56. With Q11 on, the base of Q9 is held at ground potential, Q9, Q4, Q10 and Q3 are all held off, and there is no output from the RF-808. The +24V supply is present whenever the RF-808 is plugged into the line, even though the POWER switch on the front panel is in the OFF position. Under these conditions the +6.3V line is low and the driver and output stages are held off, as described above. In this way no power is dissapated in these stages during standby periods.

6.21.2 Adjustment Procedures.

CAUTION

Ensure that RF-808 POWER ON/OFF switch is in the OFF position prior to removing the Output Amplifier Module A19 from the RF-808.

a. Remove module A19 (figures 5-1, 5-2). Extend module from main frame using, Extender Cable 808-0356.

b. Open circuit the MOD IN/OUT connector. Energize the RF-808 and set to PULSE MODULATION mode. Refer to figure 6-38 and 6-39.

c. Monitors the DC voltage at module connectors pin A19-9.

d. Adjust A19R38 to obtain a voltage reading of 1.25 VDC $\pm$ .01 volts.

e. This completes the alignment and adjustment procedure.

6.21.3 Test Data.

NOTE

In the following tables, voltages were measured with a Fluke 8100A Digital Voltmeter and waveforms obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend Output Amplifier module A19 from the RF-808 main frame. Set the RF-808 controls for PULSE mode operation. Refer to figures 6-38, 6-39 for test points and component locations and figure 6-40 for the assembly schematic diagram.

CAUTION

When A19 is operated a external to the RF-808 main frame, it is no longer connected to its heat sink. Limit operation to approximately 20 minutes. Disconnect power and allow to cool to ambient temperature before reapplying power.

TABLE 6-46. A19 TRANSISTOR VOLTAGE CHART

REF DESIG	VOLTS DC (NOMINAL)			REMARKS
	EMITTER	BASE	COLLECTOR	
Q1	+9.4	+10.2	+16.3	PULSE mode selected
Q2	+10.7	+11.4	+18.6	
Q3	+1.3	+2.0	+23.8	
Q4	+2.0	+2.7	+23.8	
Q5	+0.5	+1.2	+12.4	
Q6	+0.5	+1.2	+10.2	
Q7	+0.7	+1.3	+11.2	
Q8	+0.7	+1.4	+11.4	
Q9	+2.7	+3.5	+23.8	
Q10	+2.0	+2.7	+23.8	
Q11	0	+0.2	+3.5	
Q12	0	+0.6	+0.2	
Q13	+7.1	+7.1	−0.8	
Q14	0	0	+7.1	Base is +0.6 and collector is +0.7 with 30 DBM OUTPUT LEVEL selected.
Q15	0	0	+7.1	
Q16	0	+0.4	+1.4	

TABLE 6-47. A19 TEST POINT & CONNECTOR PIN VOLTAGE CHART

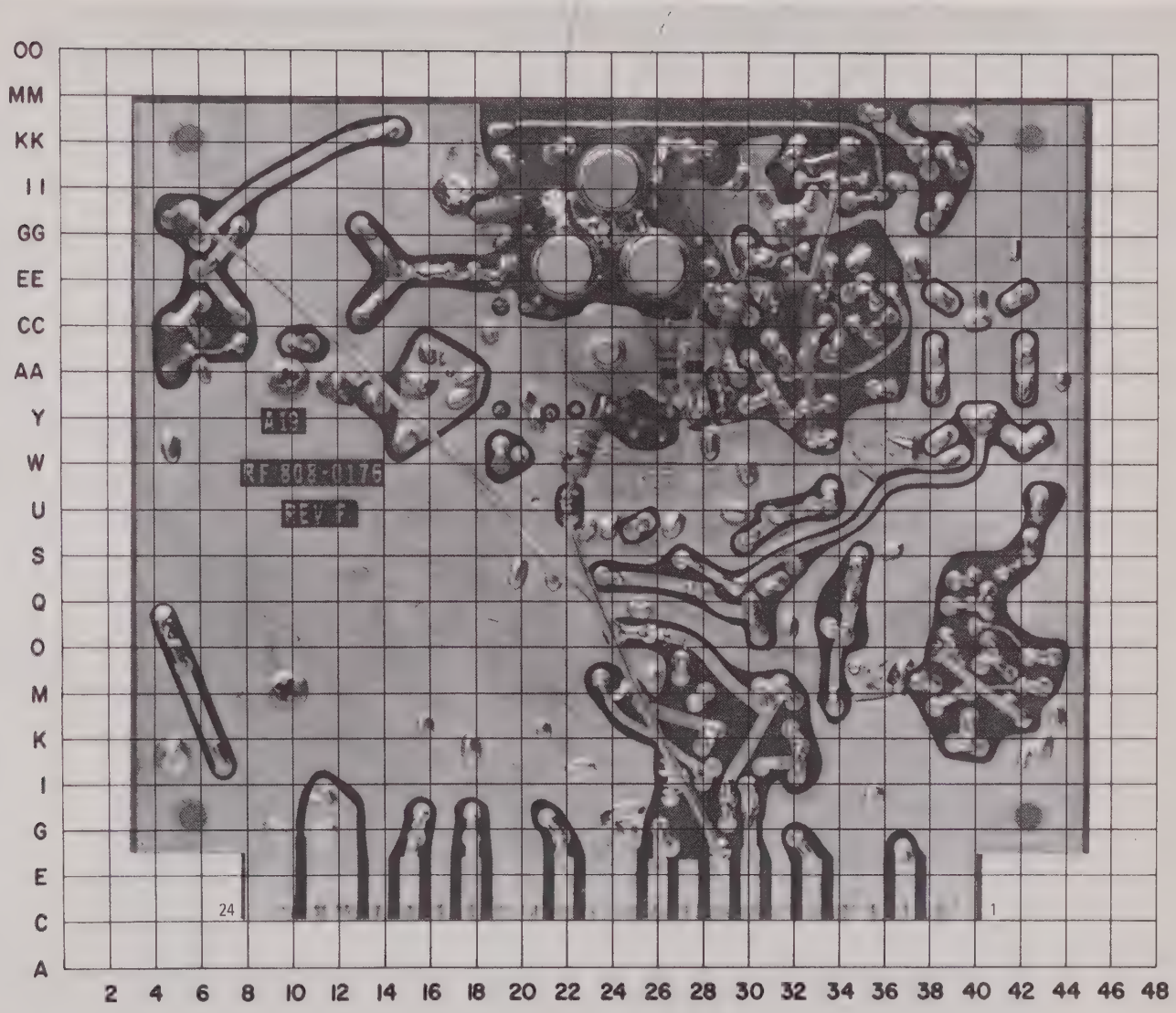
REF DESIG	VOLTS DC	REMARKS
TP1	−1.3	PULSE mode selected
Connector Pin		
2	–	
3	0	
4	0	
5	–	
6	+7.0	
7	0	
8	0	
9		
10	–	
11	−5.2	

TABLE 6-47. A19 TEST POINT & CONNECTOR PIN VOLTAGE CHART (Cont)

REF DESIG	VOLTS DC	REMARKS
12	–	PULSE mode selected
13	–	
14	0	
15	0	
16	–	
17	0	
18	–	
19	0	
20	–	
21	+24.0	
22	+24.0	

TABLE 6-48. A19 WAVEFORM CHART

REF DESIG	WAVEFORM	REMARKS
Connector Pin 3	50 mV p-p at frequency selected on front panel. Amplitude varies with OUTPUT LEVEL control.	All modes except PULSE
	80 mV p-p at frequency selected on front panel.	PULSE mode



A19

REF DESIG	LOCATION
C15	HH,21
L12	HH,18
L13	HH,19
Q3	BB,24
Q4	EE,22
Q9	II,24
Q10	EE,26
R13	X,23
R21	EE,32
R24	AA,28
R28	AA,26
R34	CC,29

Figure 6-38. Parts Location, Assembly A19 (REV G).

PARTS LOCATION GUIDE FOR FIGURE 6-39, ASSEMBLY A19

A19

REF DESIG	LOCATION
C1	H,36
C2	L,41
C3	U,17
C4	P,12
C5	Y,17
C6	N,10
C7	Y,5
C8	BB,15
C9	CC,24
C10	GG,21
C11	L,9
C12	T,6
C13	DD,13
C14	BB,19
C15	*
C16	X,22
C17	BB,19
C18	CC,22
C19	R,15
C20	GG,18
C21	X,18
C22	GG,26
C23	H,22
C24	J,22
C25	GG,14
C26	CC,28
C27	K,30
C28	I,26
C29	P,21
C30	J,28
C31	K,18
C32	W,23
C33	AA,29

CR1	W,7
CR2	AA,6
CR3	Y,7
CR4	AA,7
CR5	Y,9
CR6	AA,9
CR7	Y,10
CR8	BB,10
CR9	HH,10
CR10	CC,31
CR11	Z,33
CR12	O,19
CR13	M,17
CR14	DD,41
CR15	J,18
CR16	HH,9
CR17	II,9
K1	DD,36
L1	T,19
L2	J,37
L3	S,36
L4	II,23
L5	G,19
L6	FF,28
L7	M,11
L8	Y,12
L9	II,16
L10	T,25
L11	G,16
L12	*
L13	*
L15	X,19
L16	S,26

Q1	R,8
Q2	BB,17
Q3	*
Q4	*
Q5	M,7
Q6	P,8
Q7	BB,14
Q8	CC,12
Q9	*
Q10	*
Q11	HH,15
Q12	HH,12
Q13	Q,17
Q14	M,22
Q15	AA,40
Q16	EE,15
R1	S,14
R2	W,16
R3	L,12
R4	O,11
R5	Q,11
R6	AA,14
R7	Y,15
R8	Z,16
R9	HH,27
R10	II,26
R11	X,41
R12	AA,25
R13	*
R14	Q,6
R15	DD,16
R16	HH,20
R17	AA,27
R18	M,5
R19	O,5

R20	Z,20
R21	*
R22	EE,11
R23	V,21
R24	*
R25	O,8
R26	AA,12
R27	AA,27
R28	*
R29	V,22
R30	U,27
R31	V,24
R32	GG,16
R33	JJ,15
R34	*
R35	Y,21
R37	Q,20
R38	II,12
R39	L,20
R40	K,8
R41	JJ,30
R42	BB,29
R43	Y,31
R44	W,29
R45	FF,36
R46	BB,35
R47	P,16
R48	O,17
R49	P,23
R50	I,19
R51	I,17
R52	K,17
R53	AA,36
R54	H,15
R55	AA,26
R56	V,14
T1	W,8
T2	CC,8

*Parts on opposite side of PC Board and therefore not visible.

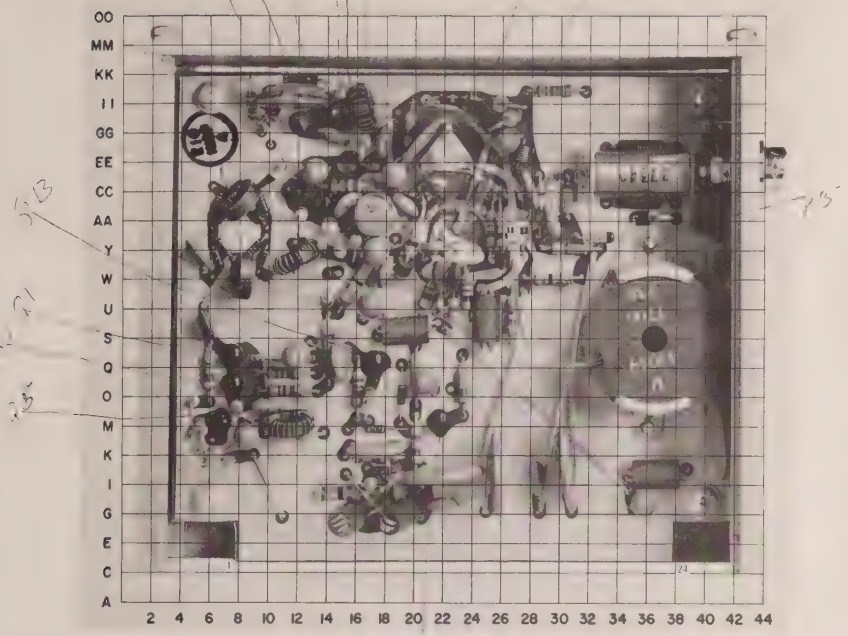


Figure 6-39. Parts Location, Assembly A19 (Component Side)

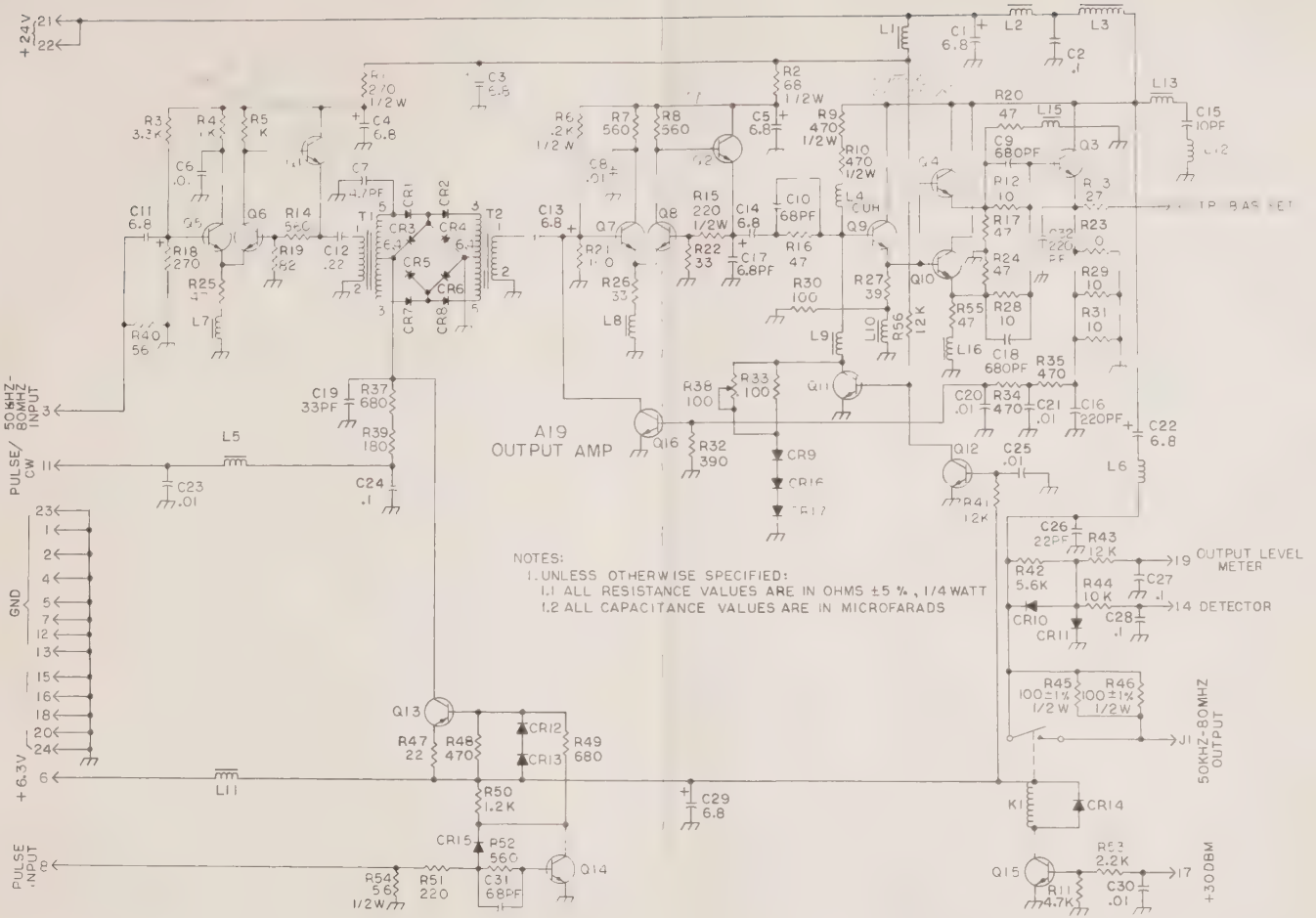


Figure 6-40. Output Amplifier Module A19, Schematic Diagram.

6.22 STANDARD DIVIDER PC BOARD A20.

6.22.1 Circuit Description.

NOTE

Prefix all reference designators in the following discussion with Standard Divider PC Board reference designator A20, unless otherwise designated.

Standard Divider PC Board A20 divides the 1 MHz output signal from the Frequency Standard Module (A21) to provide a 1 kHz signal for use throughout the RF-808 Signal Generator.

Refer to schematic diagram, figure 6-43.

IC's 1 through 6 each contain two RTL flip flops. IC1 and IC2 are interconnected to divide by 10. The signal from the 1 MHz standard on A21 enters at pin 3. The negative excursion is clipped by CR1. The resulting signal is squared by IC7 gate 14-1 and its output is the toggle input to IC1 and IC2. The waveform from IC1 pin 13 has a frequency of 100 kHz. This is further divided by 100 in the next two decade dividers and appears as a 1 kHz waveform at A20, pin 8.

An auxiliary 1 kHz output is provided at pin 10. This is applied to the calibration circuitry on A11, and is enabled by a low on pin 12 when the CAL button is depressed.

A buffered 1 MHz output on pin 11 feeds the rear panel STD IN/OUT connector J7 when the internal frequency standard is in use.

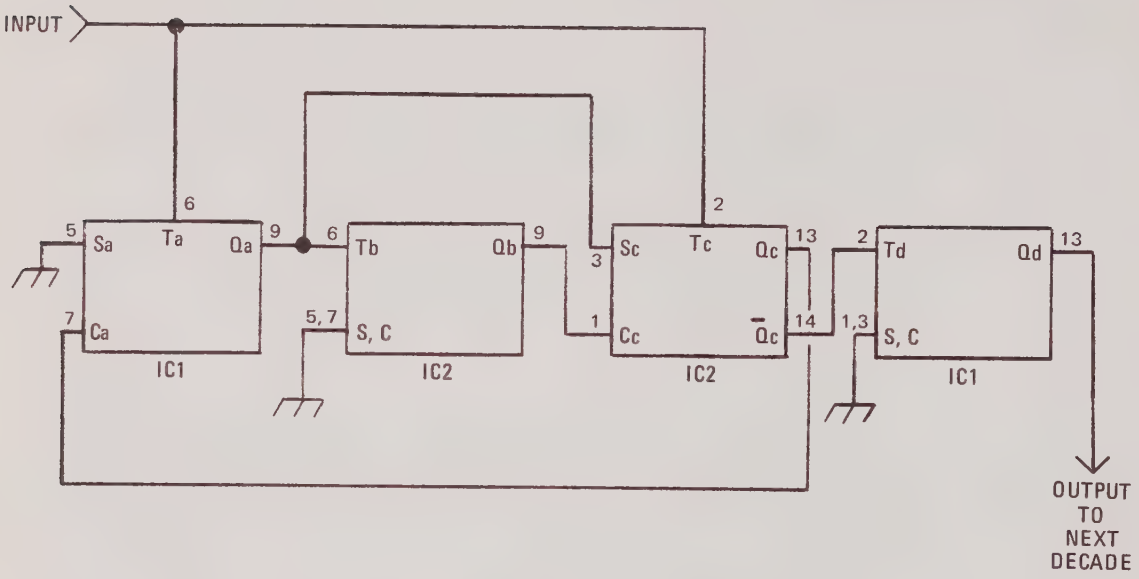
The counting sequence for each decade divider is shown in figure 6-41.

6.22.2 Test Data.

NOTE

In the following waveform chart waveforms were obtained with a Tektronix Oscilloscope, model 543 with a 1A1 plug-in amplifier. Production tolerances and use of other test equipment will result in data that may vary slightly from that shown.

For all tests, extend Standard Divider PC Board A20 from the RF-808 main frame. Refer to figure 6-42 for test points and component locations and figure 6-43 for the assembly schematic diagram.



PERIOD	Qa	Qb	Qc	Qd
0	0	0	0	0
1	1	0	1	1
2	0	1	1	1
3	0	1	0	1
4	1	1	0	1
5	0	0	0	1
6	1	0	1	0
7	0	1	1	0
8	0	1	0	0
9	1	1	0	0
10	0	0	0	0

Figure 6-41. Standard Divider Sequence.

TABLE 6-49. A20 WAVEFORM CHART

TEST POINT	WAVEFORM
E3	1000 kHz @ 6V p-p
IC7-14	1000 kHz @ +1.6V –0.6V
IC7-1	RTL logic levels fo = 1000 kHz
IC1-9	RTL logic levels fo = 400 kHz
IC2-9	RTL logic levels fo = 200 kHz
IC2-13	RTL logic levels fo = 200 kHz
IC2-14	RTL logic levels fo = 200 kHz
IC1-13 (TP-1)	RTL logic levels fo = 100 kHz
IC3-9	RTL logic levels fo = 40 kHz

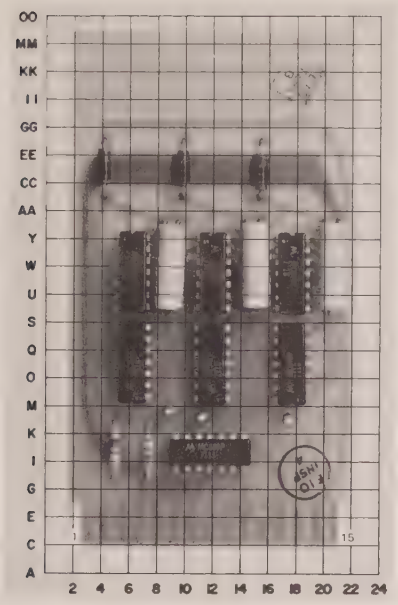
TABLE 6-49. A20 WAVEFORM CHART (Cont)

TEST POINT	WAVEFORM
IC4-9	RTL logic levels fo = 20 kHz
IC4-13	RTL logic levels fo = 20 kHz
IC4-14	RTL logic levels fo = 20 kHz
IC3-13 (TP-2)	RTL logic levels fo = 10 kHz
IC7-12	RTL logic levels fo = 10 kHz
IC7-3	RTL logic levels fo = 10 kHz
IC5-9	RTL logic levels fo = 4 kHz
IC6-9	RTL logic levels fo = 2 kHz
IC6-13	RTL logic levels fo = 2 kHz

TABLE 6-49. A20 WAVEFORM CHART (Cont)

TEST POINT	WAVEFORM
IC6-14	RTL logic levels fo = 2 kHz
IC5-13 (TP-3)	RTL logic levels fo = 1 kHz
IC5-14	RTL logic levels fo = 1 kHz
IC7-5	RTL logic levels fo = 1 kHz
IC7-6*	RTL logic levels fo = 0 (1 state)
IC7-6**	RTL logic levels fo = 1 kHz

*IC7-8 = 1
**IC7-8 = 0



A20

REF DESIG	LOCATION
C1	W,9
C2	W,15
C3	W,21
CR1	J,8
IC1	Q,6
IC2	W,6
IC3	Q,12
IC4	W,12
IC5	Q,18
IC6	W,18
IC7	I,12
L1	DD,4
L2	DD,10
L3	DD,16
R1	J,5

Test Points

TP1	M,9
TP2	L,11
TP3	L,17

Figure 6-42. Parts Location, Assembly A20 (REV D).

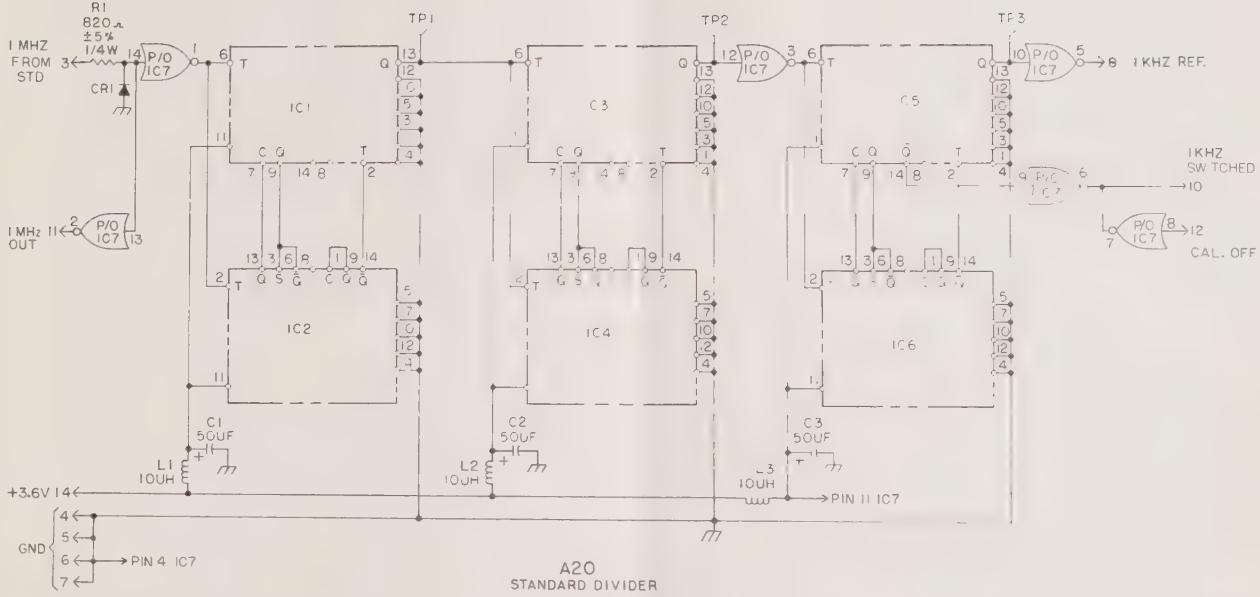


Figure 6-43. Standard Divider PC Board A20, Schematic Diagram.

6.23 FREQUENCY STANDARD MODULE A21.

6.23.1 Circuit Description.

Frequency Standard Module A21 is a sealed non-repairable unit powered by the +24V supply. The crystal oscillator circuitry is maintained at a constant temperature inside a thermostatically controlled oven whenever the RF-808 is plugged in. In this way the frequency stability of the oscillator is maintained over a wide range of ambient temperature and ON/OFF cycles.

The oscillator frequency is adjusted at the factory to the required tolerance and should not normally require readjustment in service. If, however, as a result of aging, the oscillator needs to be reset, the procedure outlined in paragraph 6.23.2 should be followed.

6.23.2 Adjustment Procedures.

a. Frequency Accuracy. In order to check the frequency accuracy of the generator, it is necessary to use a special laboratory test setup capable of absolute accuracy to within a few parts in 10^{10} or better. It is also necessary to have had the frequency standard in the generator energized for 24 continuous hours before its full stability can be realized. The following procedure is intended as a guide for those who may have suitable facilities or who may wish to use the facilities of a contract laboratory to check accuracy. The RF-808 is adjusted at the factory to within its initial tolerance, using a setup similar to that in figure 6-44; and resetting should not be necessary. However, if desired, adjustment for frequency may be made after 24 hours of continuous warmup by referring to the following procedures.

(1) Refer to figure 6-44, and make a similar test setup.

(2) Determine frequency error as explained in the instruction manual for the Error Expander. Using the setup shown, the error read on the counter will be 1000 times the actual error between the two 1 MHz standards.

b. Frequency Standard Calibration Procedure.

NOTE

Frequency standard must be activated for at least 24 hours before making frequency adjustments.

(1) Remove RF-808 top cover (paragraph 5.3.2).

(2) Make test set up as shown in figure 6-44.

(3) Unscrew and remove cap screw from adjustment hole at top of frequency standard shield can.

(4) Insert insulated shank tuning tool, such as a J.F.D. No. 5284 through the hole. Engage the slot in the frequency trimmer, and turn the adjustment slowly until the proper frequency is indicated on the counter.

(5) Turn equipment off, reinstall cap screw in frequency standard, and reinstall top cover.

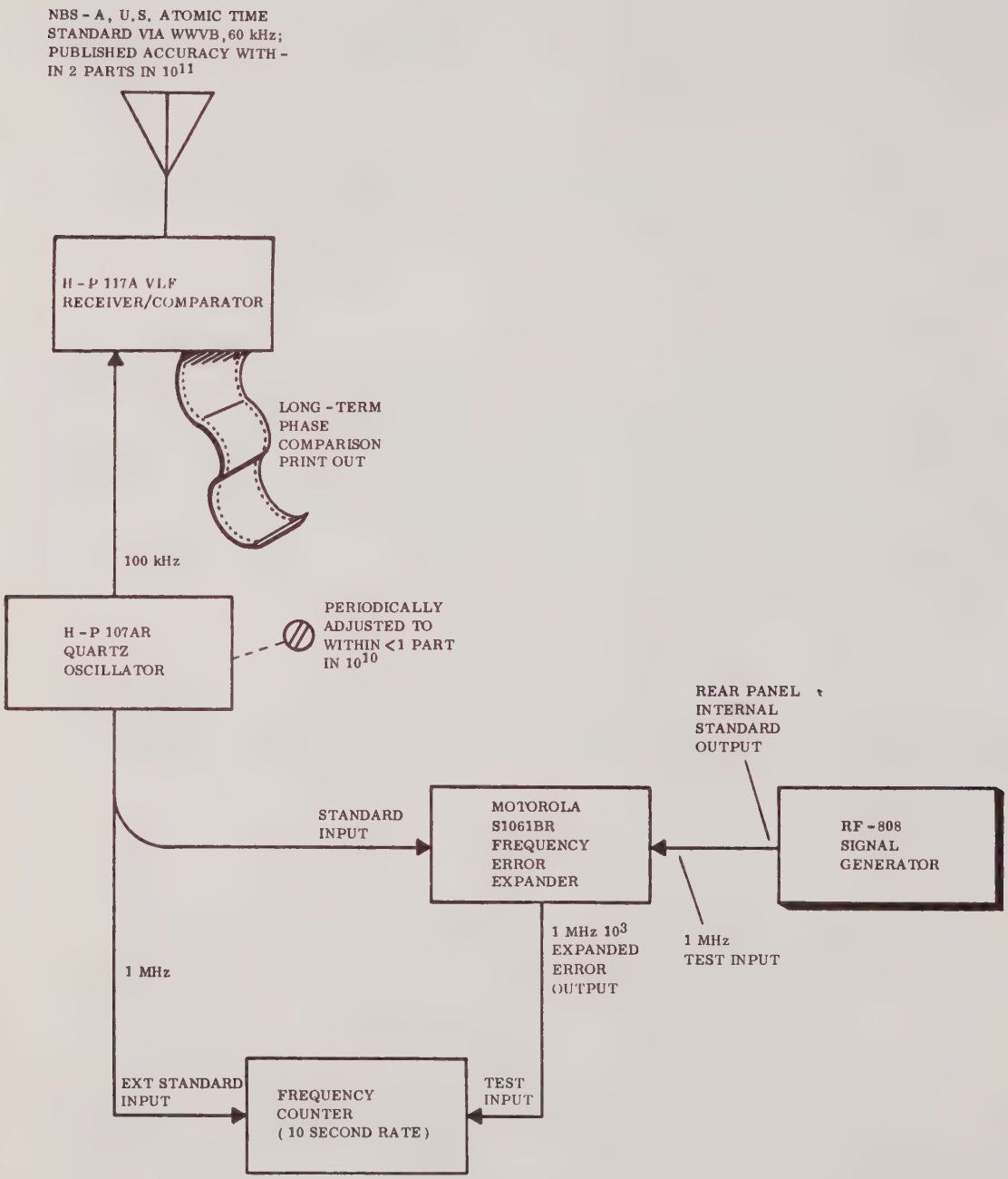

NBS - A, U.S. ATOMIC TIME STANDARD VIA WWVB, 60 kHz; PUBLISHED ACCURACY WITH - IN 2 PARTS IN 10^{11}
H - P 117A VLF RECEIVER/COMPARATOR
LONG - TERM PHASE COMPARISON PRINT OUT
100 kHz
H - P 107AR QUARTZ OSCILLATOR
PERIODICALLY ADJUSTED TO WITHIN <1 PART IN 10^{10}
REAR PANEL INTERNAL STANDARD OUTPUT
STANDARD INPUT
MOTOROLA S1061BR FREQUENCY ERROR EXPANDER
RF - 808 SIGNAL GENERATOR
1 MHz 10^3 EXPANDED ERROR OUTPUT
1 MHz TEST INPUT
1 MHz
EXT STANDARD INPUT
FREQUENCY COUNTER (10 SECOND RATE)
TEST INPUT

Figure 6-44. Suitable Test Setup for Checking or Calibrating RF-808 Frequency Standard.

6.24 SYSTEM ALIGNMENT AND ADJUSTMENT.

Whenever modules or printed circuit board assemblies are repaired or replaced, the following alignment and adjustment procedures should be performed to ensure satisfactory performance of the RF-808 Signal Generator.

a. PRELIMINARY CHECKS. Set the controls and switches on the front and rear panels as follows:

(1) POWER: Off
(2) POWER CORD: Not plugged in
(3) INPUT POWER SWITCH (rear panel): 115V or 230V, according to line voltage.
(4) FREQUENCY: 20.000 MHZ

NOTE

All knobs should be in alignment and the DTM operating properly before proceeding with the next step.

(5) VERNIER: 000

NOTE

Vernier counter should be adjusted properly before proceeding with the next step.

(6) CAL CONTROL: Mid-range
(7) CAL SWITCH: Off
(8) FM DEVIATION KHZ: 15
(9) MODULATION FREQUENCY: EXT
(10) MOD LEVEL: Mid-range
(11) SWEEP: OFF
(12) SWEEP RATE: Mid-range
(13) SWEEP RATE SWITCH: FAST
(14) SWEEP RANGE SELECT: ± 50 KHZ
(15) OUTPUT LEVEL SWITCH: +10 DBM
(16) VARIABLE LEVEL CONTROL: Mid-range
(17) +30 DBM SWITCH: OFF
(18) MANUAL SWEEP CONTROL: Set the MANUAL SWEEP control CCW. In this position the "0" line on the dial should line up exactly with the "0" line on the front panel. If this is not the case, adjust the dial to meet this requirement. With the above condition met, adjust the dial plate such that the MAN line is in exact alignment with the "–5" line on the dial.
(19) FREQ STD (rear panel): INT
(20) AM: AC
(21) Mechanically zero both meters.

b. Extend A13 Power Supply Regulator PC Board from RF-808 chassis with Extender Board 808-0170.

c. Plug in the POWER CORD and with the DVM connected to XA13-12, adjust A13-R29 for +24V ± 0.1V.

d. Set the POWER switch to ON and set the supply voltages using the DVM connected to the pins indicated in the following chart. (See figure 6.45 for location of potentiometers).

Voltage	Pin	Control	Voltage Setting
+12V	A13-18	A13R17	+12.0V ± 0.1V
−12V	A13-5	A13R42	−12.0V ± 0.1V
+3.6V	A13-23	A13R8	+3.6V ± 0.1V
−5.2V	A13-6	A13R34	−5.2V ± 0.01V
+24V	A13-12	A13R25	+24V ± 0.01V

Upon completion of these adjustments, set the POWER switch to OFF and unplug the POWER CORD. Remove extender from the POWER SUPPLY Regulator (A13) and install the Regulator in the chassis. Plug in POWER CORD and set POWER switch to ON. Connect the scope probe to the connector pins indicated in the above table and check for regulator oscillations. The scope should be set for maximum sensitivity (100 mV/cm min) in the AC position.

e. 20–30 MHz LOOP CHECK. Connect a coaxial cable from the FREQ STD – INT OUT Connector through an amplifier to the external standard input of the counter. Connect a coaxial cable from the input of the counter to XA18-19 with the shield to XA18-20.

f. Set the front panel FREQUENCY controls as given below and note the frequency measured on the counter. The READY lamp should remain on for all these tests.

	Frequency Setting MHz	Measured Frequency MHz ± 1 Hz
(1)	20.000	20.000 000
(2)	21.000	21.000 000
(3)	22.000	22.000 000
(4)	23.000	23.000 000
(5)	24.000	24.000 000
(6)	25.000	25.000 000
(7)	26.000	26.000 000
(8)	27.000	27.000 000
(9)	28.000	28.000 000
(10)	29.000	29.000 000
(11)	20.100	20.100 000
(12)	20.200	20.200 000
(13)	20.300	20.300 000
(14)	20.400	20.400 000
(15)	20.500	20.500 000
(16)	20.600	20.600 000
(17)	20.700	20.700 000
(18)	20.800	20.800 000
(19)	20.900	20.900 000

	Frequency Setting MHz	Measured Frequency MHz ± 1 Hz
(20)	24.100	24.100 000
(21)	24.200	24.200 000
(22)	24.300	24.300 000
(23)	24.400	24.400 000
(24)	24.500	24.500 000
(25)	24.600	24.600 000
(26)	24.700	24.700 000
(27)	24.800	24.800 000
(28)	24.900	24.900 000
(29)	25.000	25.500 000
(30)	25.100	25.100 000
(31)	25.200	25.200 000
(32)	25.300	25.300 000
(33)	25.400	25.400 000
(34)	25.500	25.500 000
(35)	25.600	25.600 000
(36)	25.700	25.700 000
(37)	25.800	25.800 000
(38)	25.900	25.900 000
(39)	29.000	29.000 000
(40)	29.100	29.100 000
(41)	29.200	29.200 000
(42)	29.300	29.300 000
(43)	29.400	29.400 000
(44)	29.500	29.500 000
(45)	29.600	29.600 000
(46)	29.700	29.700 000
(47)	29.800	29.800 000
(48)	29.900	29.900 000
(49)	29.910	29.910 000
(50)	29.920	29.920 000
(51)	29.930	29.930 000
(52)	29.940	29.940 000
(53)	29.950	29.950 000
(54)	29.960	29.960 000
(55)	29.970	29.970 000
(56)	29.980	29.980 000
(57)	29.990	29.990 000
(58)	29.991	29.991 000
(59)	29.992	29.992 000
(60)	29.993	29.993 000
(61)	29.994	29.994 000
(62)	29.995	29.995 000
(63)	29.996	29.996 000
(64)	29.997	29.997 000
(65)	29.998	29.998 000
(66)	29.999	29.999 000
(67)	24.999	24.999 000

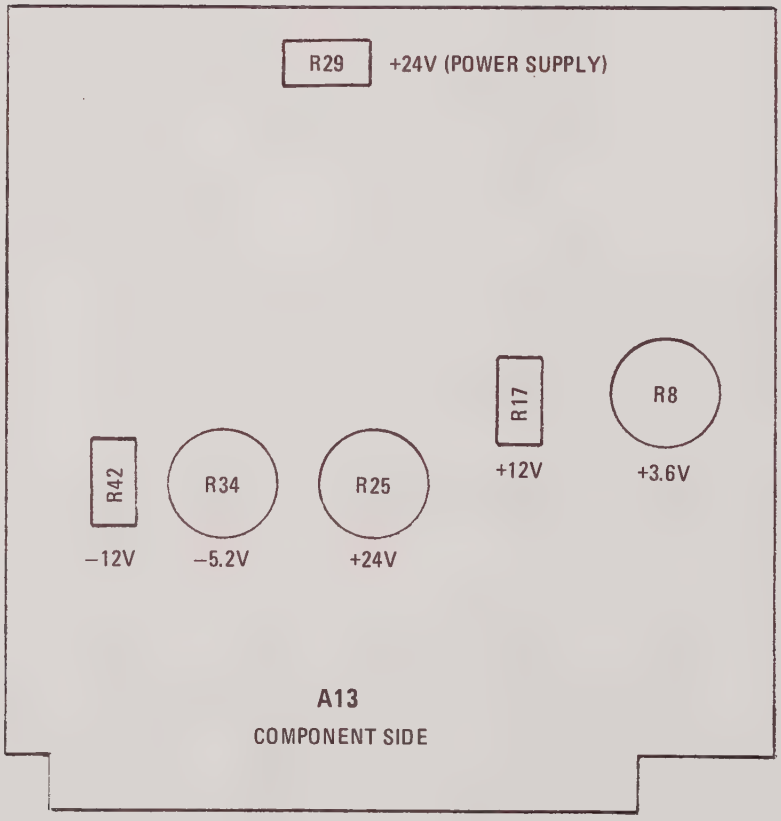


Figure 6-45. Power Supply Regulator PC Board A13, Adjustment Controls.

g. With the counter connected to the RF-808 frequency standard, connect a coaxial cable from the counter input to the RF OUTPUT. Connect the 91H with a 50 ohm termination to the RF UNCAL output on the rear panel. The level at this output should be greater than 100 mV rms. Measure this level and the frequency for the following FREQUENCY settings:

	Frequency Setting – MHz	Measured Frequency – MHz ± 1 Hz
(1)	1.000	1.000 000
(2)	11.000	11.000 000
(3)	21.000	21.000 000
(4)	31.000	31.000 000
(5)	41.000	41.000 000
(6)	51.000	51.000 000
(7)	61.000	61.000 000
(8)	71.000	71.000 000
(9)	79.000	79.000 000

While at 79.0 MHz, rotate the VARIABLE LEVEL control from a fully CCW position to about Mid-range. The OUTPUT LEVEL meter should indicate accordingly.

h. Set the FREQUENCY to 5.000 MHz and note the counter reading. A reading of 5.000 000 MHz ± 1Hz should be obtained. Depress the FM button and note the frequency. Again a reading of 5.000 000 MHz ± 1 Hz should be obtained. Disconnect the counter from the RF OUTPUT and depress the 0 DBM OUTPUT LEVEL button. Also depress the CW button. Connect the HP Analyzer to the RF OUTPUT connector and adjust the analyzer for a full screen display (10 db/div.). Accordingly, adjust the analyzer's bandwidth and scan width to measure the 1 kHz sidebands. Adjust A9C8 for minimum 1 kHz sidebands. Connect the probe of the scope to A9TP3 and set the slope of the ramp by means of A9R8 to 1V/10 microseconds. Install the module cover/shield for the A6, A7, A8 and A9 boards.

i. Connect the scope with a 50 ohm termination to the RF OUTPUT. Depress the AM button and the 400 Hz MODULATION button. Vary the MOD LEVEL control and observe the modulated RF output on the scope. Depress the 1000 Hz MODULATION button and again observe the output on the scope while varying the MOD LEVEL control. Depress the EXT MODULATION button and connect an external audio oscillator to the MOD IN/OUT connector. Set the oscillator for a frequency of approx 1000 Hz and a level of approx 1.5 vrms. Vary the MOD LEVEL control and observe the modulated output on the scope. Remove the External Audio Oscillator and connect the scope without the termination to the MOD IN/OUT connector. Depress the 1000 Hz MODULATION button and observe the 1000 Hz output on the scope.

j. Depress the PULSE MODULATION button and note that the OUTPUT LEVEL meter goes to zero. Apply +1.5V to the MOD IN/OUT connector. Observe that the reading on the OUTPUT LEVEL meter increases. Disconnect the +1.5V source from the MOD IN/OUT connector.

k. Connect the counter input to the RF OUTPUT connector and to press the CW button. Depress the VERN button and observe the frequency reading on the counter. The SWEEP lamp should be on. Rotate the VERNIER knob and observe that the frequency changes. Depress the CAL button to ON and observe the beats on the OUTPUT LEVEL meter every 100 Hz as the VERNIER control is rotated. The CAL lamp should be on. Depress the CAL button once more to release it.

l. MANUAL SWEEP CHECK. Depress the MAN button and for the following conditions rotate the MANUAL SWEEP control, noting that the output frequency changes by the appropriate amount. Check for zero beat deflection on the output meter at the center frequency for the cases indicated. Depress CAL ON/OFF button to ON.

(1) Depress the ± 500 Hz button, noting the frequency change and zero beat.
(2) Depress the ± 5 kHz button, and note the frequency change.
(3) Depress the ± 50 kHz button, noting the frequency change and zero beat.
(4) Depress the ± 500 kHz button, and note the frequency change.
(5) Depress the ± 5 MHz button and note the frequency change.
(6) Depress the 0–80 MHz button and vary the MANUAL SWEEP control over the full range. The highest frequency reading obtained should be greater than 80 MHz.

m. AUTO SWEEP CHECK.

(1) Depress the ± 500 kHz button.
(2) Release the CAL button.
(3) Rotate MANUAL SWEEP control fully CW.
(4) Depress the AUTO button.
(5) Connect the scope to the SWEEP OUT connector and set scope for LINE triggering.
(6) Depress LINE button and observe a locked sawtooth waveform.
(7) Depress the VAR button and set the FAST/SLOW switch to the FAST position. Set the scope for INT triggering. Vary the RATE control from the CCW end stop to the CW end position. Note the change in frequency of the sawtooth from minimum to maximum of 6 to 80 sweeps per second respectively.
(8) Set the FAST/SLOW switch to the SLOW position. Vary the RATE control from the fully CCW position to the CW end stop. Note the change in the duration of the sawtooth from minimum to maximum of 8 to 100 seconds respectively.
(9) Depress the ONE SHOT button during a sweep and note the retrace.
(10) Depress the TRIG button. Press the ONE SHOT button and note the sweep start. Press the ONE SHOT button again and note the retrace.
(11) Apply +1.5V momentarily to the TRIG INPUT on the rear panel. Note that the sweep is initiated.
(12) Depress the VAR button and set the FAST/SLOW switch to FAST. Connect a scope to the BLANKING output on the rear panel and note that the output is a pulse waveform.
(13) Depress the OFF button (SWEEP).

n. POWER SUPPLY ADJUSTMENTS. Set POWER switch to OFF and disconnect the POWER LINE. Remove the Power Supply Regulator board (A13) and install on extender board. Plug-in POWER CORD and with the DVM connected to XA13-12, adjust A13R29 for +24V ± .05V.

o. Set the POWER switch to ON and set the supply voltages using the DVM connected to the indicated pins. (See Figure 6-45 for location of potentiometers.)

Voltage	Pin	Control	Voltage Setting
+12V	A11-12	A13R17	+11.995V +0V, −.01V
−12V	A11-11	A13R42	−11.995V +0V, −.01V
+3.6V	A13-23	A13R8	+3.6V ± .03V
−5.2V	A13-6	A13R34	−5.2V ± .03V
+24V	A13-12	A13R25	+24V ± .05V

Upon completion of these adjustments set the POWER switch to OFF and unplug the POWER CORD. Remove extender from the Power Supply Regulator board (A13) and install the Regulator in the chassis. Plug in POWER CORD and set POWER switch to ON. Connect the scope probe to the connector pins indicated in the above table and check for oscillations. The scope should be set for maximum sensitivity (100 mV/cm) in the AC position.

p. SWEEP ADJUSTMENT. (See figure 6-46).

(1) Connect the scope to the SWEEP OUT connector and depress the ± 5 kHZ and the AUTO buttons.

(2) Adjust A5R45 and A5R55 to obtain a ± 5.0V sawtooth. Control A5R45 is used to adjust the lower limit of the sweep while A5R55 adjusts the upper limit. Set the sweep amplitude to within ± 0.2V of each limit. Disconnect the scope from the SWEEP OUT connector.

(3) Connect the scope probe to the output of the Sweep Buffer at the top of A3R5. Set the MANUAL SWEEP control fully CW and adjust the Sweep Amplitude control A5R69 for a sweep voltage of 12V ± 0.2V. Readjust A5R55 for an upper limit of +6V ± 0.1V. Set A5R45 for a lower limit of −6V ± 0.1V. In these adjustments it may be necessary to adjust A5R69 slightly to achieve the required sweep voltage (± 6V ± 0.1V).

(4) With the FAST/SLOW switch in the FAST position, vary the RATE control from the fully CCW position to the CW end stop. The sweep frequency should vary from 6 to 80 sweeps/sec.

(5) With the FAST/SLOW Switch in the SLOW position, vary the RATE control from the fully CCW position to the CW end stop. One sweep should vary from 8 to 100 seconds in duration.

(6) Depress the 0−80 MHz button and observe that the sweep buffer output at pin A11-15 varies from −2.4V to +2.4V as the MANUAL SWEEP control is rotated. Set the MANUAL SWEEP control fully CCW and measure with the DVM the voltage at pin A11-5. This voltage should be −2.4V ± .05V.

(7) Depress the VERN button. Adjust A3R3 on the SWEEP BUFFER to give +1.200 ± .01 volts at pin 3 of the vernier potentiometer A2R4.

(8) Set the VERNIER DIAL to 000. Connect a DVM to pin 1 of the vernier potentiometer A2R4. Adjust the CAL control to obtain a reading of .000 ± .0005 volts.

(9) Adjust A11A2C5 to obtain an output frequency of 5.000 000 kHz ± 1 Hz.

(10) Set the VERNIER dial to 999. Adjust A3R3 to obtain a frequency of 5.000 999 kHz ± 1 Hz.

(11) Depress the MAN sweep button. Select the ± 5 kHz sweep range and set the MANUAL SWEEP control in the fully CCW position. Connect the DVM to the output of the sweep buffer (A11-15). Adjust A5R88 for a sweep buffer output of −6.00 ± .02V. Note that the output frequency is within 150 Hz of setting.

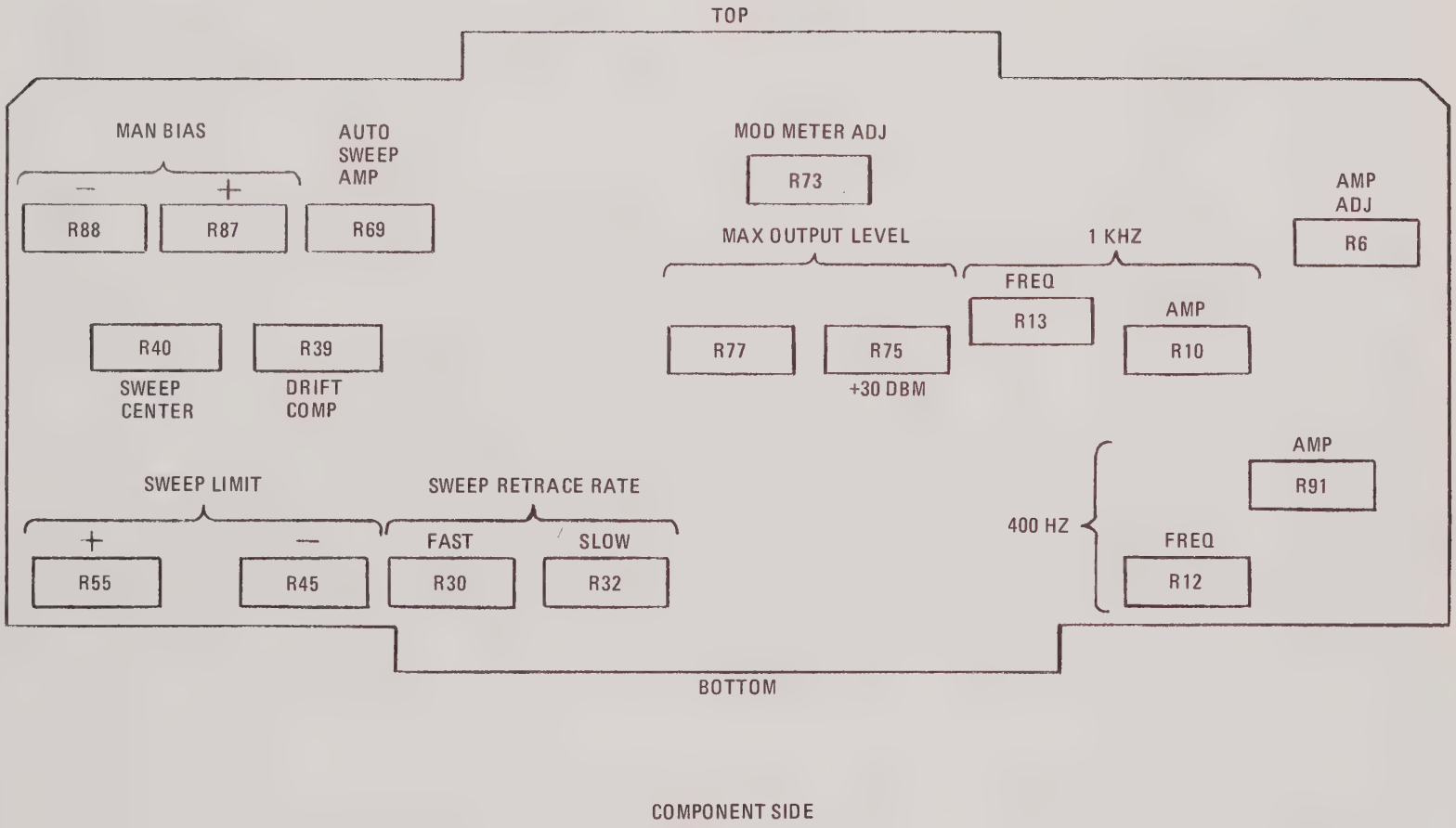


Figure 6-46. Modulation/Sweep PC Board A5, Adjustment Controls.

(12) Set the MANUAL SWEEP control to +5 kHz and adjust A5R87 for a sweep buffer output of +6.00 ± .02 volts. Note that the output frequency is within 150 Hz of setting.

(13) Depress the ± 500 Hz sweep range button. Note that the output frequency is within 25 Hz of setting.

(14) Set the MANUAL SWEEP control in the fully CCW position. Note that the output frequency is within 25 Hz of setting.

(15) Depress the ± 50 kHz sweep range button. Connect a DVM to the output of the sweep buffer. Set the MANUAL SWEEP control to obtain a .0000 (± .0005) volt reading. Adjust A11A2C16 to obtain a frequency of 5,000.000 kHz ± 500 Hz.

(16) Set the MANUAL SWEEP control in the fully CCW position. Note that the output frequency is within 2.5 kHz at setting.

(17) Set the MANUAL SWEEP control to +50 kHz. Note that the output frequency is within 2.5 kHz of setting.

(18) Depress the ± 500 kHz sweep range button. Note that the output frequency is within 2 5 kHz of setting.

(19) Set the MANUAL SWEEP control in the fully CCW position. Note that the output frequency is within 25 kHz of setting.

(20) Depress the ± 5 MHz button. Connect a DVM to the sweep buffer output (A11-15). Set the MANUAL SWEEP control to obtain .0000 volts ± .0005 volts. Set the output frequency to 40,000 kHz. Adjust A16R6 to obtain an output frequency of 40,000 kHz ± 25 kHz.

(21) Set the MANUAL SWEEP control to +5 and then to −5. Adjust A16R88 to obtain ± 5 MHz within ± 50 kHz.

(22) Depress the 0 to 80 MHz sweep button. Vary the output frequency over the full range by adjusting the MANUAL SWEEP control slowly. The high frequency reading obtained should be 80 MHz at about 80 MHz on the dial. Below 1 MHz, a sweep circuit is used to prevent a latch up condition near zero frequency. Note that the frequency at which the sweep circuit starts is below 1 MHz.

q. RF OUTPUT LEVEL ADJUSTMENTS.

(1) Set the output frequency to 5.000 MHz. With the 50 ohm probe connected to a 91H RFVM set RANGE switch to the 70 dB position. Adjust the ZERO control for a minimum. Set the RANGE switch to 0 dB and connect the probe to the RF OUTPUT connector. Depress the +20 DBM button and set the VARIABLE LEVEL control for a 0 dB reading on the meter. Depress the OUTPUT LEVEL buttons indicated below and note the corresponding 91H meter reading.

	Output Level Button	Meter Reading
(a)	+20 DBM	0 dB (Ref
(b)	+10 DBM	−10 dB ± 1 dB
(c)	0 DBM	−20 dB ± 1 dB
(d)	−20 DBM	−40 dB ± 1 dB
(e)	−60 DBM	−80 dB ± 1.5 dB

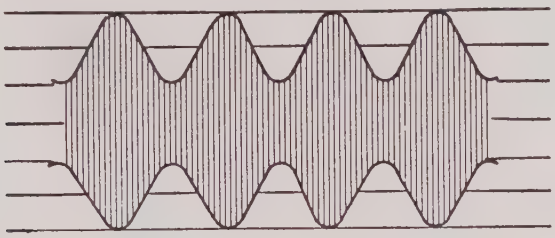
(2) Set the OUTPUT frequency to 79.000 MHz. The change in the −60 dBm reading obtained in (e), above should be no greater than ± 0.5 dB.

(3) Set the RANGE switch of the 91H to 10 dB and connect a 20 dB 2 watt pad between the RF OUTPUT connector and the 91H 50 ohm probe. Set the +30 DBM switch to ON and note that the RF output level drops to zero. Depress the +30 DBM button and note the meter reading on the 91H. A reading should be obtained 10 dB ± 1 dB less than that in step 1(a) above.
(4) Set the OUTPUT frequency to 5.000 MHz. Depress the 0 DBM button and set the VARIABLE LEVEL control for 0 dBm output. Connect the RF OUTPUT to the HP Spectrum Analyzer and obtain a full screen presentation.
(5) Set the VARIABLE LEVEL control fully CCW. Adjust A18R20 to obtain a minimum output level as viewed on the HP Analyzer. Then adjust A18R20 until the output level increases by 1 dB above this minimum.
(6) Adjust A18R6 to obtain a minimum output level as viewed on the HP Analyzer. Then adjust A18R6 until the output level increases by 1 dB above this minimum.
(7) Repeat steps (5) and (6) above.

r. RF OUTPUT CALIBRATION.
(1) Depress the +20 DBM button.
(2) Turn the VARIABLE LEVEL control CCW.
(3) Connect the 91H RFVM with the 50 Ohm probe to the RF OUTPUT connector. Set the 91H to the 3.0V range.
(4) Turn the VARIABLE LEVEL control to approximately 90% of its range.
(5) Adjust A5R77 to obtain a reading of 3.0V rms on the 91H. Turn the VARIABLE LEVEL control fully CW and note that an output of greater than 3.16V rms is obtained.
(6) Set the VARIABLE LEVEL control to obtain a reading of 2.0V rms on the 91H. Adjust A4R1 behind the front panel to obtain a front panel meter reading of 2.0V rms.
(7) Set the VARIABLE LEVEL to 3.0V rms.
(8) Connect the 91H with the 50 Ohm probe through a 20 dB 2 watt pad to the RF OUTPUT connector. Set the 91H to the 1.0V range.
(9) Set the +30 DBM switch to ON and depress the +30 DBM button.
(10) Adjust A5R75 for an output of 0.95V rms on the 91H RFVM.
(11) Adjust A4R2 behind the front panel to obtain a front panel reading of 1.0V rms.
(12) Turn the VARIABLE LEVEL control fully CW and note that an output of greater than 1.05V rms is obtained.
(13) Set the FREQUENCY controls to 50 kHz and note that the output is at least 1.00V rms on the 91H.
(14) Set the FREQUENCY controls to 79.9 MHz and note that the output is at least 1.0V rms on the 91H. Disconnect the 91H from the RF OUTPUT connector.

s. AM/FM CALIBRATION.
(1) Set the FREQUENCY controls to 5.000 MHz.
(2) Depress the 0 DBM button.
(3) Depress the AM MODULATION button.
(4) Depress the EXT MODULATION button.
(5) Set the VARIABLE LEVEL Control for an output of 200 mV rms.
(6) Set the MOD LEVEL control fully CCW.
(7) Connect an audio oscillator to the MOD IN/OUT connector and to a frequency counter. Set the oscillator to 2 kHz and its output level to a minimum.

(8) Set the MOD LEVEL control fully CW.
(9) Increase the external oscillator's level until a 100% reading is obtained on the MOD LEVEL METER.
(10) Set the MOD LEVEL control for a 90% reading on the MOD LEVEL METER and then adjust the oscillator level for a 100% reading.
(11) Connect the RF OUTPUT connector to the input of a scope using 50 ohm coaxial cable. Terminate the scope input in 50 ohms.
(12) By simultaneously adjusting the 2 kHz external modulation level and the vertical gain of the scope, set the modulation as viewed on the scope for 50%.



(13) Adjust A5R73 for a 50% reading on the MOD LEVEL METER.
(14) Depress the CW button and set the FM DEVIATION SWITCH to 15 kHz.
(15) Connect the RF OUTPUT to HP 8553B/8552B, Spectrum Analyzer and set the SCAN WIDTH to .5 kHz /DIV. Adjust the BANDWIDTH, SCAN TIME and SENSITIVITY to obtain a suitable full screen presentation on the analyzer. Center the carrier on the screen.
(16) Depress the FM pushbutton and set the MOD LEVEL control for a deviation of 15.0 kHz as read on the MOD LEVEL METER. Adjust the external audio generator to 2717 Hz.
(17) Set the POWER switch to OFF.
(18) Extend Discriminator PC Board (A16) from RF-808 with Extender board.
(19) Set the POWER switch to ON and note that the Spectrum Analyzer presentation and MOD LEVEL METER reading have not changed from those in step (16), above.
(20) Depress the CW button and note the full screen deflection of the carrier.
(21) Depress the FM button and adjust A16R91 until the carrier is nulled to greater than −40 dB.
(22) Set the POWER switch to OFF. Replace Discriminator PC Board (A16) in the RF-808.
(23) Set the POWER switch to ON and note that the Spectrum Analyzer presentation and MOD LEVEL METER reading have not changed from those in step (22), above.
(24) Set the FM DEVIATION switch to 5 kHz and adjust the MOD LEVEL control to obtain 5 kHz on the MOD LEVEL METER. Set the audio generator to approximately 2,083 Hz, then vary the audio frequency to obtain a carrier null of greater than −40 dB. Note that the frequency of the audio generator lies within the range of 2,021 to 2,145 Hz.
(25) Set the FM DEVIATION switch to 75 kHz and adjust the MOD LEVEL control to obtain 75 kHz on the MOD level meter. Set the audio generator to approximately 5023 Hz. Vary the audio frequency to obtain a carrier null of greater than −40 dB. Note that the frequency of the audio generator lies in the range of 4,899 tp 5,147 Hz. Vary the MOD LEVEL control from the minimum setting. Observe that the carrier will go thru six nulls before reaching the 75 kHz meter reading.

(26) Set the FM DEVIATION switch to 375 kHz and adjust the MOD LEVEL control to obtain 375 kHz deviation on the MOD LEVEL METER. Set the audio generator to approximately 12,239 Hz. Then vary the audio frequency to obtain a carrier null of greater than −40 dB. Note that the frequency of the audio generator lies in the range 11,872 to 12,606 Hz. Vary the MOD LEVEL control from the minimum setting. Observe that the carrier will go thru ten nulls before reaching the 375 kHz meter reading.

t. PULSE MODE.

(1) Depress the PULSE MODULATION button. Connect +1.5V source to the MOD IN/OUT connector. Observe the output level on the output meter. Determine the frequency with the lowest output by checking the following frequencies.

50 kHz	9050 kHz
1050 kHz	10050 kHz
2050 kHz	20050 kHz
3050 kHz	30050 kHz
4050 kHz	40050 kHz
5050 kHz	50050 kHz
6050 kHz	60050 kHz
7050 kHz	70050 kHz
8050 kHz	79050 kHz

(2) At the lowest output frequency, depress the +30 DBM OUTPUT LEVEL button. Set the +30 DBM switch to ON. Connect a 91H RF Voltmeter, via a 20 dB 2 watt attenuator to the RF OUTPUT connector. Adjust A18R16 to obtain 10.5V.

u. Measure the +12V and −12V lines at pin A11-12 and A11-11, respectively. Readjust the regulator if necessary to 11.995V.

v. Apply locking cement (Glyptol) to all potentiometers and the lamp on the MOD/SWEEP board A5, after all final adjustments are completed.

CHAPTER 7

PARTS LIST

7.1 PARTS LIST.

The following parts list tables cover all electrical parts, and those mechanical parts which might be required for replacement purposes. Electrical parts are listed by assembly in alpha-numeric (reference designation) order, as marked on the schematic diagram in Section 6. Listings include the reference designation, a description of the part, and the part number. Refer to table 5-1 for a listing of RF-808 assemblies. Refer to appropriate parts location photos and schematics in Section 6 to aid in parts identification.

The following listing defines the conventions and abbreviations used in this parts list.

a. All capacitors values are microfarads unless specified otherwise.

b. All inductor values are microhenries unless specified otherwise.

c. All resistor values are in ohms, with multiplying factors as given.

d. Abbreviations used:

pF	=	picofarad
K	=	resistor-value multiplying factor of 1000
W	=	watt
V	=	volts
FET	=	Field Effect Transistor
Comp	=	composition
T	=	turns
mh	=	millihenry

7.2 ORDERING REPLACEMENT PARTS.

To obtain replacement parts, address your order or inquiry to your local RF Communications Inc. representative. Identify parts being ordered by giving the part number and part description as given in the parts list.

To order a part which is not listed, supply the following information:

a. Instrument model number.

b. Instrument serial number.

c. Detailed description of the part.

d. Function and location of the part.

REF. DESIG.	DESCRIPTION	PART NUMBER
C2 C5	8200 MFD, 25 VDC CAP PWR SUPPLY	CX028 22250
	POWER SUPPLY BOARD	808-0134-1
	FRONT PANEL ASSEMBLY PARTS (NO PREFIX)	
DS1	Indicator Lamp, Red	XX050000
DS1	Indicator Lamp, Green	XX050001
DS3	Same as DS1	
J8,J9	Connector	JX080625
M1	Meter	MX068081
M2	Meter	MX068082
R1-R3	Potentiometer, 2.5K	RX3500252
R7,R8	Resistor, ¼W, 33, 5%	RX011330
R13	Resistor, ¼W, 1180, 1%	RX1021181
R14	Resistor, ¼W, 162, 1%	RX1021620
R15	Resistor, ¼W, 30.1, 1%	RX10230R1
R16	Resistor, ¼W, 10, 1%	RX10210R0
R17,R18	Resistor, ¼W, 2.7K, 5%	RX011272
R19	Resistor, ¼W, 127, 1%	RX1021270
R20	Resistor, ¼W, 1.5K	RX011152
R21	Resistor, ¼W, 1.8 Megohm, 5%	RX011185
R22	Resistor, ¼W, 2.2K, 5%	RX011222
R23	Resistor, ¼W, 100, 5%	RX011101
R24	Same as R22	
R25	Resistor, ¼W, 10K	RX011103
S10-S16	Switch, Push	SX058084
S17-S22	Switch, Push	SX058081
S41	Switch, Push	SX058083
S42,S43	Switch, Slide	SX091122
S44	Switch, Slide	SX092144
S45	Switch, Rocker	SX071022
	REAR PANEL ASSEMBLY PARTS (NO PREFIX)	
	Bushing, AC Cord, Strain Relief	HX008051
	Cord, AC Line	WX050000
	Cover, Transistor	MP420001
F1	Fuse, 1.5 Ampere, Slo-Blo	FX011152
F2	Fuse, .5 Ampere, Slo-Blo	FX011501

REF. DESIG.	DESCRIPTION	PART NUMBER
FL1	Line Filter	808-0102
J2-J4	Connector	JX080625
J5	Plug, Banana , Red	PX200000
J6	Plug, Banana , Black	PX200001
J7	Same as J2	
Q1	Transistor, 2N3055	QX053055
Q3,Q4	Same as Q1	
R28	Resistor, ¼W, 6.8K, 5%	RX011682
R29	Resistor, ¼W, 1K, 5%	RX011102
S46-49	Switch, Slide	SX090022
XF1,XF2	Fuseholder	XX020000
	MAIN (CHASSIS) ASSEMBLY PARTS (NO PREFIX)	
	Knob, Sweep Control, Outer	808-0186
	Knob, Inner, Main Sweep	MP198086
	Knob,"0-9"	MP198087
	Knob,"0-7"	MP198088
	Knob, Vernier	MP198082
	Vernier Assembly	808-0189
A21	Crystal, 1.000 MHz Standard	YX018082
R6	Potentiometer, Two Speed	RX398081
R9	Resistor, ¼W, 10K, 5%	RX011103
R10	Resistor, ¼W, 220, 5%	RX011221
	RECTIFIER BOARD PARTS (NO PREFIX)	
	Rectifier Board Assembly	808-0134-1
CR1-CR8	Diode, 1N2070	CR918051
CR9	Diode, 1N914	CR100914
CR10-CR13	Same as CR1	
R1	Resistor, ¼W, 10K	RX011103

REF. DESIG.	DESCRIPTION	PART NUMBER
A3	PC BOARD ASSEMBLY, SWEEP BUFFER	808-181
C1	Capacitor, 470pF	CX061471
C2	Capacitor,22pF	CX0600220
C3	Capacitor 220pF	CX061221
C4-C6	Capacitor,.01pF	CX064103
C7	Capacitor, 6.80, 35V	CX15685M35
CR1	Diode, 1N277	CR050277
CR2	Diode, 1N914	CR100914
IC1	Integrated Circuit, SN72709N	IC0510709
Q1	Transistor, 2N5138	QX055138
Q2,Q3	Transistor, 2N5172	QX055172
R1	Resistor, 1%, 1K	RX1021001
R2	Resistor, 1%, 15K	RX1021502
R3	Potentiometer, Wirewound, 5K	RX370502
R4	Resistor, ¼W, 1.5K	RX011152
R5	Resistor, 1%, 9.09K	RX1029091
R6	Resistor, ¼W, 390	RX011391
R7	Resistor, ¼W, 820	RX011821
R8	Resistor, ¼W, 10K	RX011103
R9	Resistor, ¼W, 1K	RX011102
R10	Resistor, ¼W, 1.2K	RX011122
R11	Resistor, ¼W, 2.7K	RX011272
R12	Resistor, ¼W, 3.9K	RX011392

REF. DESIG.	DESCRIPTION	PART NUMBER
A4	PC BOARD ASSEMBLY, ATTENUATOR SWITCH	808-0125
R1	Potentiometer, Carbon, 10K	RX200103
R2	Potentiometer, Carbon, 50K	RX200503
R3	Resistor, ¼W, 470	RX011471
R4	Resistor, ¼W, 12K	RX011123
R5	Resistor, ¼W, 56K	RX011563
S23-S31, S32-S40	Switch Assembly	SX058085

REF. DESIG.	DESCRIPTION	PART NUMBER
A5	PC BOARD ASSEMBLY, MODULATION/SWEEP	808-0145
C1,C2	Capacitor, 50, 15V	CX0150015
C3	Capacitor, .001, 500V	CX061102
C4	Same as C1	
C5-C7	Capacitor, 4700pF, 63V	CX13471630
C8	Capacitor, 5.6, 100V	CX23565101
C9	Capacitor,4700pF, 500V	CX061472
C10	Capacitor, 220pF, 500V	CX061221
C11	Capacitor, 150pF, 500V	CX061151
C12	Capacitor, .01	CX064103
C13	Capacitor, 6.8, 35V	CX15685M35
C14	Capacitor, 250, 15V	CX01251015
C15, C16	Same as C1	
C17	Same as C14	
C18, C19	Same as C1	
CR1-CR8	Diode, 1N914	CR100914
CR9-CR10	Diode, 1N2070	CR918051
CR11	Not Used	
CR12, CR13	Same as CR9	
CR14	Diode 1N277	CR050277
CR15	Same as CR9	
DS1	Lamp, Incandescent	DS050000
IC1	Integrated Circuit, SN72709N	IC0510709
IC2-IC4	Integrated Circuit, MC824P	IC0510824
K1-K5	Relay, reed	KX208081
Q1, Q2	Transistor, 2N5138	QX055138
Q3, Q4	Transistor, 2N5133	QX055133
Q5, Q6	Transistor, U1994E	QX958083
Q7-Q10	Same as Q1	
Q11	Transistor, 2N4354	QX054354
Q12	Same as Q1	
Q13	Same as Q5	
Q14	Same as Q11	
Q15	Same as Q1	
Q16	Same as Q3	
Q17	Transistor, 2N5172	QX055172
Q18	Transistor, 2N3053	QX053053
Q19	Same as Q3	
Q20	Same as Q1	
Q21-Q28	Same as Q17	

REF. DESIG.	DESCRIPTION	PART NUMBER
Q29,Q30	Same as Q3	
Q31,Q32	Same as Q1	
Q33,Q34	Same as Q17	
Q35	Same as Q1	
Q36	Same as Q3	
Q37	Same as Q1	
Q38	Same as Q3	
Q39	Same as Q1	
Q40	Same as Q3	
R1	Resistor, ¼W, 10K	RX011103
R2	Resistor, ¼W, 2.2K	RX011222
R3	Resistor, ¼W, 120	RX011121
R4	Resistor, ¼W, 820	RX011821
R5	Resistor, ¼W, 100	RX011101
R6	Potentiometer, Carbon, 1K	RX200102
R7	Resistor, ¼W, 8.2K	RX011822
R8	Resistor, ¼W, 180	RX011181
R9	Resistor ¼W, 39K	RX011393
R10	Potentiometer, Carbon, 25K	RX200253
R11	Resistor,¼W, 33K	RX011333
R12	Same as R10	
R13	Potentiometer, Carbon, 10K	RX200103
R14	Resistor, ¼W, 6.8K	RX011682
R15	Resistor, ¼W, 22K	RX011223
R16	Same as R1	
R17, R18	Resistor, ¼W, 1K	RX011102
R19, R20	Same as R1	
R21,R22	Resistor, ¼W, 1.8K	RX011182
R23	Same as R1	
R24	Same as R17	
R25	Same as R21	
R26	Resistor, ¼W, 2.7K	RX011272
R27-R29	Same as R1	
R30	Potentiometer, Carbon, 500	RX200501
R31	Resistor, ¼W, 680	RX011681
R32	Potentiometer, Carbon, 100K	RX200104
R33	Same as R5	
R34	Same as R1	
R35	Same as R2	
R36, R37	Same as R17	
R38	Resistor, ¼W, 4.7K	RX011472
R39	Resistor, ¼W, 3.3K	RX011332
R40	Potentiometer, Carbon, 5K	RX200502
R41	Resistor, ¼W, 1.5K	RX011152
R42	Same as R17	
R43	Same as R2	
R44	Same as R17	
R45	Same as R6	

REF. DESIG.	DESCRIPTION	PART NUMBER
R46	Same as R39	
R47	Same as R1	
R48	Same as R15	
R49, R50	Same as R17	
R51	Resistor, ¼W, 330	RX011331
R52,R53	Same as R1	
R54	Same as R39	
R55	Same as R6	
R56-R58	Same as R39	
R59-R61	Same as R17	
R62,R63	Same as R1	
R64	Resistor, ¼W, 82K	RX011823
R65	Same as R26	
R66	Same as R1	
R67	Same as R39	
R68	Same as R1	
R69	Same as R13	
R70	Same as R17	
R71	Same as R38	
R72	Same as R 1	
R73	Same as R10	
R74	Same as R17	
R75	Same as R10	
R76	Same as R2	
R77	Same as R10	
R78	Same as R2	
R79	Same as R17	
R80	Resistor, ¼W, 470	RX011471
R81	Resistor, ¼W, 3.9K	RX011392
R82	Resistor, ¼W, 5.6K	RX011562
R83-R85	Same as R1	
R86	Same as R38	
R87,R88	Potentiometer, Carbon, 100	RX200101
R89	Same as R26	
R90	Resistor, ¼W, 15K	RX011153
R91	Potentiometer, Carbon, 50K	RX200503
R92	Resistor, ¼W, 56K	RX011563
R93	Same as R2	
R94	Same as R15	
R95	Resistor, 1%, 2K	RX022001
R96	Same as R1	
R97	Same as R26	
R98	Same as R14	
R99	Same as R1	
R100	Same as R3	
R101	Same as R38	
R102	Same as R14	
R103,R104	Same as R1	

REF. DESIG.	DESCRIPTION	PART NUMBER
R105	Same as R14	
R106	Same as R38	
R107	Resistor, ¼W, 33	RX011220
R108	Same as R8	
R109	Resistor, ¼W, 220	RX011331
R110	Same as R90	
VR1-VR3	Diode, Zener, 1N751A	CR150751

REF. DESIG.	DESCRIPTION	PART NUMBER
A6	PC BOARD ASSEMBLY, LOW SPEED DIVIDER	808-0155
C1-C3	Capacitor, 50, 15V	CX0150015
C4,C5	Capacitor, .001, 500V	CX061102
C6,C7	Capacitor, 6.8, 35V	CX15685M35
CR1	Diode, 1N277	CR050277
IC1	Integrated Circuit, MC890P	808-0343-5
IC2	Integrated Circuit, Select,MC891P	808-0343-1
IC3	Integrated Circuit	IC0510825
IC4	Integrated Circuit	IC0510889
IC5	Integrated Circuit	IC0510824
IC6	Same as IC3	
IC7	Same as IC5	
IC8	Integrated Circuit, MC890P	808-0343-6
IC9	Integrated Circuit,Select,MC891P	808-0343-4
IC10	Same as IC1	
IC11	Integrated Circuit	IC0510891
IC12	Same as IC3	
IC13	Same as IC4	
IC14	Same as IC5	
IC15	Same as IC3	
IC16	Same as IC5	
IC17	Same as IC8	
IC18	Same as IC9	
IC19	Same as IC1	
IC20	Same as IC11	
IC21	Same as IC3	
IC22	Same as IC4	
IC23	Same as IC5	
IC24	Same as IC3	
IC25	Same as IC5	
IC26	Same as IC8	
IC27	Same as IC9	
IC28	Same as IC11	
IC29	Same as IC3	
L1-L3	Choke, 4.7	LX0180811
R1	Resistor, ¼W, 3.3K	RX011332
R2	Not used	
R3	Same as R1	
R4	Not used	
R5	Same as R1	
R6	Not used	
R7-R14	Resistor, ¼W, 6.8K	RX011682
R15	Resistor, ¼W, 2.2K	RX011222
R16	Resistor, ¼W, 4.7K	RX011472

REF. DESIG.	DESCRIPTION	PART NUMBER
A7	PC BOARD ASSEMBLY, HIGH SPEED DIVIDER	808-0152
C1,C2	Capacitor, 50 , 15V	CX0150015
C3	Capacitor, .001, 500V	CX061102
C4	Capacitor, 150pF, 500V	CX061151
C5	Same as C3	
C6	Capacitor, 0.1, 100V	CX063104
C7	Same as C1	
C8-C19	Capacitor, .01, 500V	CX064103
IC1	Integrated Circuit, MC1023P	IC0511023
IC2-IC6	Integrated Circuit, MC1013P	IC0511013
IC7-IC16	Integrated Circuit, MC1005P	IC0511005
IC17	Integrated Circuit, MC1010P	IC0511010
IC18	Integrated Circuit, MC1007P	IC0511007
IC19	Integrated Circuit, MC889P	IC0510889
IC20	Same as IC2	
IC21	Integrated Circuit, MC1022P	IC0511022
IC22	Same as IC2	
IC23	Integrated Circuit, MC1022P	IC0511022
L1-L3	Choke, 10	LX0180814
Q1-Q4	Transistor, 2N5138	QX055138
Q5	Transistor, 2N5133	QX055133
R1-R3	Resistor, ¼W, 10K	RX011103
R4,R5	Resistor, ¼W, 10	RX011100
R6	Resistor, ¼W, 1.5K	RX011152
R8	Same as R1	
R9	Resistor, ¼W, 4.7K	RX011472
R10	Resistor, ¼W, 6.8K	RX011682
R11	Resistor, ¼W, 3.3K	RX011332
R12	Resistor, ¼W, 1K	RX011102
R13	Resistor, ¼W, 2.2K	RX011222
R14	Resistor, ¼W, 8.2K	RX011822
R15	Same as R12	
R16	Same as R11	
R17	Resistor, ¼W, 2.7K	RX011272
R18-R20	Same as R6	
R21-R24	Same as R13	
R25-R28	Same as R9	

REF. DESIG.	DESCRIPTION	PART NUMBER
A8	PC BOARD ASSEMBLY, 20-30 MHZ OSC	808-0168
C1	Capacitor, .01	CX064103
C2,C3	Capacitor, 250, 15V	CX01251015
C7	Capacitor, .001	CX061102
C10	Same as C1	
C11,C12	Same as C2	
C15,C16	Same as C2	
C17	Capacitor, 50, 15V	CX0150015
C18	Same as C1	
C19	Capacitor, Ceramic, 10pF	CX6600100
C20	Same as C1	
C21	Same as C7	
C22	Same as C1	
C23-C25	Capacitor, 150pF	CX661151
C26	Same as C17	
C27,C28	Same as C1	
C29	Capacitor, 20pF	CX0600200
C30	Same as C1	
C31	Same as C7	
C32	Capacitor, 150pF	CX061151
C33-C36	Same as C1	
CR1-CR5	Diode, 1N914	CR100914
CR9,CR10	Varicap, 1N5456B	CR205456
CR11,CR12	Diode, HP2800	CR102800
CR13,CR14	Same as CR9	
CR15,CR16	Same as CR11	
IC1	Integrated Circuit MC-870P	IC0510870
IC2	Integrated Circuit MC-1010	IC0511010
L1,L2	Inductor, 33	LX0180817
L3	Inductor,Toroid	TX928087
L4	Inductor, Toroid	TX928088
L5-L11	Inductor,33	LX0180017
Q1-Q5	Transistor, 2N5172	QX055172
Q6-Q10	Transistor, 2N5138	QX055138
Q12-Q14	Transistor	QX0540222
Q15-Q16	FET, 2N5486	QX055486
Q17-Q19	Transistor, 2N5172	QX055172
Q20	Transistor,U1994E	QX958083
Q21	Transistor, 2N4258	QX054258
Q22	Same as Q12	
Q23	Same as Q6	
R1-R3	Resistor, ¼W,68	RX011680
R4	Resistor, ¼W,10K	RX011103
R5, R6	Resistor, ½W,470	RX012471

REF. DESIG.	DESCRIPTION	PART NUMBER
R7-R15	Same as R4	
R16	Resistor ¼W, 4.7K	RX011472
R17	Resistor ¼W, 22K	RX011223
R18	Same as R16	
R19	Same as R17	
R20	Same as R16	
R21	Same as R17	
R22	Same as R16	
R23	Same as R17	
R24	Same as R16	
R25	Same as R17	
R26	Resistor, Metal Film ¼W,4530	RX1024531
R27-R30	Resistor, ¼W, 6.8K	RX011682
R31	Resistor, Metal Film ¼W, 1.0K	RX1021001
R32	Resistor, Metal Film ¼W, 33.2K	RX1023322
R33	Resistor, Metal Film ¼W, 2.49K	RX1022491
R34	Resistor, Metal Film ¼W, 15K	RX1021502
R35	Resistor, Metal Film ¼W, 5760	RX1025761
R36	Resistor, Metal Film ¼W, 2.15K	RX1022151
R38	Same as R16	
R39	Same as R17	
R41-R43	Same as R1	
R44	Resistor, Metal Film ¼W, 1.5K	RX011152
R45	Resistor, Metal Film ¼W, 47	RX011470
R46	Same as R4	
R47	Same as R45	
R48	Resistor, Variable, 10K	RX200103
R49	Resistor, ¼W,68K	RX011683
R50	Resistor, Metal Film ¼W,3010	RX1023011
R51	Resistor, Metal Film ¼W,3920	RX1023921
R52	Resistor, Metal Film ¼W,5110	RX1025111
R53	Resistor, Metal Film ¼W,6810	RX1026811
R54	Resistor, Metal Film ¼W, 9090	RX1029091
R57	Same as R44	
R58	Same as R16	
R59	Resistor, Metal Film ¼W, 2.7K	RX011272
R60	Resistor, Metal Film ¼W, 100K	RX011104
R61	Same as R5	
R62	Same as R4	
R63	Same as R16	
R64	Resistor, Metal Film ¼W, 560	RX011561
R65	Resistor, Variable, 10K	RX200103
R66	Resistor, ¼W, 150K	RX011154
R67	Same as R5	
R68	Same as R60	
R69	Resistor ¼W, 560	RX011561
R70	Same as R16	
R71	Same as R60	
R72	Same as R64	
R73,R74	Resistor, Metal Film, 3.01K	RX1023011

REF. DESIG.	DESCRIPTION	PART NUMBER
A9	P C BOARD ASSEMBLY SWEEP/SAMPLE & HOLD	808-0140
C1,C2	Capacitor, 250, 15V	CX01251015
C3	Capacitor, 0.1, 33V	CX13104330
C4-C6	Not Used	
C7	Capacitor, .0033, 33V	CX13332630
C8	Capacitor, .2-2.7 pF	CX188081
C9	Same as C7	
C10	Not used	
C11	Capacitor, 220 pF	CX061221
C12	Same as C1	
C13	Capacitor, .1	CX063104
C14,C15	Capacitor, 6.8, 35V	CX15685M35
C16,C17	Capacitor, .01	CX064103
C18,C19	Same as C1	
CR1-CR4	Diode, 1N914	CR100914
CR5-CR8	Diode, 1N277	CR050277
CR9	Same as CR1	
IC1	Integrated Circuit, MC824P	IC0510824
L1	Choke, 33	LX0180817
Q1	Transistor, 2N4275	QX054275
Q2-Q4	Transistor, 2N5138	QX055138
Q5	Transistor, 2N5133	QX055133
Q6	Same as Q2	
Q7	Same as Q5	
Q8	Same as Q2	
Q9	Same as Q5	
Q10	Same as Q2	
Q11	Same as Q5	
Q12	Same as Q2	
Q13	Same as Q5	
Q15,Q16	Transistor, 3N164	QX0501641
Q17	Transistor, FET	QX0539622
Q18	Same as Q5	
Q19-Q21	Transistor, 2N5172	QX055172
Q22	Transistor	QX054022
Q23,Q24	Same as Q2	
R1	Resistor, ¼W, 10K	RX011103
R3	Resistor, ¼W, 100	RX011101
R4	Resistor, ¼W, 470	RX011471
R5	Resistor, ¼W, 1K	RX011102

REF. DESIG.	DESCRIPTION	PART NUMBER
R6	Same as R1	
R7	Resistor, ¼W, 33K	RX011333
R8	Resistor, ¼W, 68	RX011680
R9	Same as R3	
R10	Thermistor,KB2551	RX308081
R11	Same as R5	
R12	Resistor, 100K	RX011104
R13	Same as R1	
R14	Resistor, ¼W, 8.2K	RX011822
R15	Same as R1	
R16	Not used	
R18	Same as R4	
R19	Resistor, ¼W , 3.3K	RX011332
R20	Same as R5	
R21	Same as R19	
R22	Same as R5	
R23	Same as R3	
R24	Same as R5	
R25,R26	Resistor, ¼W , 18K	RX011183
R27	Same as R3	
R29	Same as R25	
R31	Same as R1	
R32	Resistor, ¼W, 2.2K	RX011222
R35	Same as R5	
R36	Same as R1	
R37	Resistor, ¼W, 680K	RX011684
R38,R39	Same as R5	
R40	Resistor, ¼W, 27K	RX011273
R41, R42	Same as R1	
R43	Resistor, ¼W, 5.6K	RX011562
R44	Resistor, ¼W, 4.7K	RX011472
R45, R46	Same as R1	

REF. DESIG.	DESCRIPTION	PART NUMBER
A10	PC BOARD ASSEMBLY, 20 MHZ PLL	808-0165-1
C1	Capacitor, 470pF	CX061471
C2	Capacitor, 22pF	CX0600220
C3	Same as C1	
C4-C8	Capacitor, .01	CX064103
C9	Capacitor, 220pF	CX061221
C10	Capacitor, 680pF	CX061681
C11	Capacitor, 6.8	CX15685M35
C12	Not Used	
C13	Same as C9	
C14	Capacitor, 10pF	CX0600100
C15-C17	Same as C4	
C18	Capacitor, 68pF	CX0600680
C19	Capacitor, 680pF	CX07681501
C20-C22	Same as C4	
C23,C24	Capacitor, .001	CX061102
C25	Same as C4	
C26,C27	Same as C23	
C28-C31	Same as C4	
C32-C34	Same as C11	
C35	Same as C4	
C36	Same as C11	
C37	Same as C4	
C38,C39	Same as C11	
C40	Same as C4	
C41	Same as C11	
C42	Capacitor, 47pF	CX0600470
C43-C45	Same as C4	
C46	Capacitor, 4.7pF	CX06004700
C47	Same as C1	
C48	Same as C4	
C49	Same as C4	
CR1,CR2	Diode, 1N914	CR100914
CR3	Diode, Varicap	CR202111
CR4-CR7	Diode, Hot Carrier	CR102800
IC1	Integrated Circuit	IC0511010
IC2	Integrated Circuit	IC0510709
IC3	Same as IC1	
IC4	Integrated Circuit	IC0511013
IC5	Same as IC1	
L1	Choke, 47	LX0180818
L2	Choke, 33	LX0180817
L3	Coil, Tapped,	LX918084

REF. DESIG.	DESCRIPTION	PART NUMBER
L4	Same as L2	
L5	Choke, 1.5	LX018088
L6	Choke, 100	LX0180821
L7	Same as L5	
L8	Same as L2	
L9	Choke, 15	LX0180815
L10-L13	Same as L2	
Q1-Q3	Transistor	QX053563
R1	Resistor, ¼W, 470	RX011471
R2	Resistor, ¼W, 330	RX011331
R3	Resistor, ¼W, 4.7K	RX011472
R4	Resistor, ¼W, 8.2K	RX011822
R5	Resistor, ¼W, 10K	RX011103
R6	Same as R1	
R7	Resistor, ¼W, 47	RX011470
R8	Resistor, ¼W, 1K	RX011102
R9	Resistor, ¼W, 22K	RX011223
R10	Resistor, ¼W, 150K	RX011153
R11	Resistor, ¼W, 33K	RX011333
R12,R13	Resistor, ¼W, 2.2K	RX011222
R14	Not Used	
R15	Resistor, ¼W, 82K	RX011823
R16	Resistor, ¼W, 1.5K	RX011152
R17	Same as R8	
R18,R19	Same as R5	
R20	Resistor, ¼W, 22	RX011220
R21	Same as R8	
R22,R23	Resistor, ¼W, 100	RX011101
R24	Same as R3	
R25	Same as R4	
R26	Same as R5	
R27	Same as R7	
R28	Same as R8	
R29	Same as R7	
R30	Same as R3	
R31	Same as R5	
R32	Resistor, ¼W,12K	RX011123
R33	Same as R5	
R34,R35	Same as R1	
R36	Same as R5	
R37	Resistor, ¼W, 150	RX011151
R38	Resistor, ¼W, 560	RX011561
T1	Transformer, Toroidal	TX928085
T2	Transformer, Toroidal	TX928084
Y1	Crystal, 20.000MHz	YX018081

REF. DESIG.	DESCRIPTION	PART NUMBER
A11	MODULE ASSEMBLY, 20 MHZ SWEEP	808-0279-1
A11A1	PC BOARD ASSEMBLY, 20 MHZ CONTROL SWEEP	808-0224-1
C1,C2	Capacitor, .01	CX064103
C3,C4	Capacitor, 6.8, 35V	CX15685M35
C5-C8	Same as C1	
C9	Not Used	
C10-C13	Same as C3	
C14	Capacitor, 0.1	CX063104
C15	Same as C1	
C16	Same as C3	
C17	Capacitor, 50, 15V	CX0150015
L1,L2	Choke, Ferrite	LX0180833
L3,L4	Choke, 33	LX0180817
Q1	Transistor, 2N5138	QX055138
Q2	Transistor, 2N5172	QX055172
Q3	FET, U1994E	QX958083
Q4,Q5	Same as Q2	
Q6	Same as Q1	
R1	Resistor, ½W, 1K	RX012102
R2	Not Used	
R3	Resistor, ¼W, 4.7K	RX011472
R4	Resistor, ¼W, 8.2K	RX011822
R5	Test Selected	
R6	Potentiometer, Carbon, 5K	RX200502
R7	Potentiometer, Carbon, 1K	RX200102
R8	Resistor, ¼W, 10K	RX011103
R9	Resistor, ¼W, 1.8K	RX011182
R10	Resistor, ¼W, 3.3K	RX011332
R12	Test Selected	
R13	Same as R6	
R14	Test Selected	
R15	Resistor, ¼W, 12K	RX011123
R16	Test Selected	
R17	Potentiometer, Carbon, 500	RX200501
R18	Resistor, ¼W, 1K	RX011102
R19	Resistor, ¼W, 5.6K	RX011562
R20	Resistor, ¼W, 820	RX011821
R21	Not Used	
R22	Same as R17	
R23	Same as R10	
R24	Same as R9	

REF. DESIG.	DESCRIPTION	PART NUMBER
R25	Resistor, ¼W, 150	RX011151
R26	Not Used	
R27	Same as R17	
R28	Same as R3	
R29	Resistor, ¼W, 1.5K	RX011152
R30	Resistor, ¼W, 470	RX011471
R31	Not Used	
R32	Same as R17	
R33	Resistor, ¼W, 2.2K	RX011222
R34	Resistor, ¼W, 220	RX011221
R35	Resistor, ¼W, 56K	RX011563
R36	Resistor, ¼W,150K	RX011154
R37	Same as R18	
R38	Resistor, ¼W, 22K	RX011223
R39	Resistor, ¼W, 100K	RX011104
R40	Resistor, ¼W, 330	RX011331
R41	Resistor, ¼W, 4.7K	RX011472
R42	Resistor, ¼W, 2.7K	RX011272
R43	Same as R18	
R44	Resistor, ¼W, 15K	RX011153

REF. DESIG.	DESCRIPTION	PART NUMBER
A11A2	PC BOARD ASSEMBLY, 20 MHZ SWEEP OSC	808-0227-1
B1, B2	Thermal Oven	HR058081
C1-C4	Capacitor, .01	CX064103
C5	Capacitor, Trimmer, 1.5-10.0pF	CX188082
C6,C7	Capacitor, 22pF	CX0600220
C8	Same as C5	
C9	Capacitor, 6.8, 35V	CX15685M35
C10-C13	Same as C1	
C14	Capacitor, N1500, 6.8pF, 5%	CX06030680
C15	Capacitor, 4.7pF	CX06004700
C16	Same as C5	
C17,C18	Same as C1	
C19	Capacitor, 100pF	CX060201
C20	Capacitor, 680pF	CX061681
C21	Same as C9	
CR1	Diode, HP2800	CR102800
CR2	Diode, MV2107	CR202107
CR3,CR4	Diode, 1N914	CR100914
CR5	Diode, MV2111	CR202111
CR6-CR8	Same as CR3	
L1	Choke, 100	LX0180821
L2,L3	Choke, 2.7	LX0180827
L4	Choke, 10	LX0180814
L5	Same as L1	
Q1	Transistor, 2N3563	QX053563
Q2,Q3	FET, U1994E	QX958083
R1	Resistor, ¼W, 1K	RX011102
R2	Resistor, ¼W, 10K	RX011103
R3	Resistor, ¼W, 8.2K	RX011822
R4	Resistor, ¼W, 22	RX011220
R5	Resistor, ¼W, 680	RX011681
R6	Resistor, ¼W, 4.7K	RX011472
R7	Resistor, ¼W, 220	RX011221
R8	Resistor, ¼W, 47	RX011470
R9	Resistor, ¼W, 3.9K	RX011392
R10	Resistor, ¼W, 1K	RX011102
R11	Same as R9	
R12	Resistor, ¼W, 22K	RX011223
T1,T2	Transformer, RF	TX928089
Y1	Crystal, 20.000MHz	YX018081

REF. DESIG.	DESCRIPTION	PART NUMBER
A11A3	PC BOARD ASSEMBLY, 20 MHZ SWEEP MOTHERBOARD	808-0175-1
C1,C2	Capacitor, .01	CX064103
C3	Capacitor, 6.8, 35V	CX15685M35
C4	Same as C1	
C5	Same as C3	
IC1	Integrated Circuit, MC1010	IC0511010
IC2	Integrated Circuit, MC890	IC0510890
IC3	Integrated Circuit, MC891	IC0510891
L1,L2	Choke, 33	LX0180817
Q1	Transistor, 2N5172	QX055172
R1	Resistor, ¼W, 4.7K	RX011472
R2,R3	Resistor, ¼W, 10K	RX011103
R4	Same as R1	
R5	Resistor, ¼W, 8.2K	RX011822
R6	Resistor, ¼W, 12K	RX011123

REF. DESIG.	DESCRIPTION	PART NUMBER
A12A1	PC BOARD ASSEMBLY, ATTENUATOR	808-0131
CR1-CR4	Diode, 1N914	CR100914
IC1	Integrated Circuit, MC889P	IC0510889
Q1-Q6	Transistor, 2N3568	QX053568
R1-R5	Resistor, ¼W, 10K	RX011103
R6	Resistor, ½W, 220	RX012221
R7	Same as R1	
R8	Same as R6	
R9	Same as R1	
R10	Same as R6	
R11	Same as R1	
R12	Same as R6	
R13	Same as R1	
R14	Resistor, ¼W, 33	RX011330
R15	Resistor, ¼W, 2.2K	RX011222
R16	Same as R1	
R17	Resistor, ¼W, 470	RX011471
R18-R21	Same as R6	

REF. DESIG.	DESCRIPTION	PART NUMBER
A13	PC BOARD ASSEMBLY, POWER SUPPLY REGULATOR	808-0137-1
C1	Capacitor, .001, 500V	CX061102
C2-C4	Capacitor, 6.8, 35V	CX15685M35
C5	Same as C1	
C6	Capacitor, .01 500V	CX062103
C7	Capacitor, 50, 15V	CX0150015
C8	Same as C6	
C9	Capacitor, .0033, 500V	CX061332
C10	Same as C2	
C11	Capacitor, 22pF, 500V	CX0600220
C12	Same as C6	
C13	Same as C11	
C14	Capacitor, 0.1, 100V	CX063104
C15	Same as C7	
C16,C17	Capacitor, .01	CX0640103
C18,C19	Capacitor, 250, 15V	CX0125015
C20	Same as C2	
CR1-CR3	Diode, 1N914	CR100914
IC1	Integrated Circuit, uA723C	IC0520723
IC2-IC5	Integrated Circuit, MC1709CP	IC0510709
Q1	Transistor, 2N3054	QX053054
Q2	Transistor, 2N5138	QX055138
Q3	Transistor, 2N3053	QX055133
Q4	Transistor	QX053053
Q5	Transistor, 2N3568	QX053568
Q6	Same as Q1	
Q7	Transistor, 2N4354	QX054354
Q8	Same as Q4	
Q9	Same as Q7	
Q10	Same as Q8	
R1	Resistor, ¼W, 1K	RX011102
R2	Resistor, ¼W, 470	RX011471
R3	Resistor, ¼W, 150	RX011151
R4,R5	Resistor, ¼W, 10K	RX011103
R6	Same as R1	
R7	Resistor, ¼W, 2.2K	RX011222
R8	Potentiometer, Wirewound	RX370252
R9	Resistor, ¼W, 1.5K	RX011152
R11	Same as R4	
R12	Same as R2	
R13	Resistor, ¼W, 560	RX011561

REF. DESIG.	DESCRIPTION	PART NUMBER
R14	Same as R9	
R15	Resistor, ¼W, 2.7K	RX011272
R16	Resistor, 1%, 3090	RX1023091
R17	Potentiometer, Carbon, 250	RX200251
R18	Resistor, 1%, 5.11K	RX1025111
R19	Resistor, ¼W, 33	RX011330
R20	Resistor, ¼W, 330	RX011331
R21	Same as R2	
R22	Same as R1	
R23	Same as R9	
R24	Same as R4	
R25	Same as R8	
R26	Resistor, ¼W, 3.3K	RX011332
R27	Resistor, ¼W, 22K	RX011223
R28	Resistor, ¼W, 4.7K	RX011472
R29	Potentiometer, Carbon, 10K	RX200251
R30	Same as R2	
R31	Same as R1	
R32	Resistor, ¼W, 270	RX011271
R33	Same as R9	
R34	Same as R8	
R35	Same as R9	
R36	Resistor, ¼W, 5.6K	RX011562
R37	Same as R9	
R38	Same as R2	
R39	Same as R1	
R40	Same as R9	
R41	Selected	
R42	Potentiometer, Carbon, 250	RX200251
R43	Selected	
R44	Same as R13	
R45,R46	Resistor, 1%, 3.48K	RX1023480
R47	Resistor, ¼W, 82	RX011820
R48	Selected	
R50	Resistor, ¼W, 2.7K	RX011272
VR1	Diode, Zener, 1N756	CR150756
VR2	Diode, Zener, 1N754	CR150754

REF. DESIG.	DESCRIPTION	PART NUMBER
A14	MODULE ASSEMBLY, VHF LOOP A	808-0216-1
A14A1	PC BOARD ASSEMBLY, 300MHZ LOOP MIXER	808-0200
C1	Capacitor, .01	CX064103
C2, C3	Capacitor, 150pF	CX061151
C4-C7	Same as C1	
C8,C9	Capacitor, 100 pF	CX0602101
C10	Capacitor, 47 pF	CX0600470
C11,C12	Capacitor, 370pF	CX061471
C13	Same as C1	
C14	Same as C2	
C16-C19	Same as C1	
CR1-CR4	Diode, HP2800 (Matched Set)	Matched set of four CR102800
L1-L3	Choke, RF	LX0180832
L4	Choke, RF, .15	LX018081
L5,L6	Choke, RF, .33	LX018083
L7-L9	Same as L1	
Q1-Q4	Transistor, 2N3563	QX053563
R2	Resistor, ¼W, 47	RX111470
R3-R5	Resistor, ¼W, 3.3K	RX011332
R6	Resistor, ¼W, 150	RX112151
R7	Resistor, ¼W, 270	RX011271
R8	Resistor, ¼W, 56	RX011560
R9	Same as R6	
R10-R12	Same as R3	
R13	Same as R7	
R14	Same as R8	
R15	Selected	
R16	Same as R8	
T1	Transformer, RF	TX9280815
T2,T3	Transformer, RF	TX928083
T4	Same as T1	

REF. DESIG.	DESCRIPTION	PART NUMBER
A14A2	PC BOARD ASSEMBLY, 300 MHZ OSC	808-0201
C1	Capacitor, 150pF	CX061151
C2	Capacitor, 2.2 pF	CX06002200
C3-C5	Capacitor, 4.7 pF	CX06004700
C6	Capacitor, .01	CX064103
C7, C8	Same as C1	
C9, C10	Same as C6	
C11, C12	Same as C1	
C13	Same as C6	
C14	Not used	
C15-C19	Same as C6	
CR1	Varicap	CR202103
CR2	Diode	CR100914
L1, L2	Choke, RF, 2-3/4 Turns	808-0218-2
L3-L9	Choke, RF	LX0180832
Q1-Q3	Transistor, 2N5179	QX055179
R1	Resistor, ¼W, 470	RX011471
R2	Resistor, ¼W, 8.2K	RX011822
R3	Resistor, ¼W, 10K	RX011103
R4	Same as R1	
R5, R6	Not used	
R7	Same as R2	
R8	Same as R3	
R9	Resistor, ¼W, 100	RX011101
R10	Resistor, ¼W, 390	RX011391
R11, R12	Not Used	
R13	Same as R2	
R14	Same as R3	
R15	Same as R9	
R16	Same as R10	
R17	Resistor, ¼W, 4.7K	RX011472

REF. DESIG.	DESCRIPTION	PART NUMBER
A14A3	PC BOARD ASSEMBLY, 280 MHZ MIXER	808-0202
C1	Capacitor, .01	CX064103
C2,C3	Capacitor, 150pF	CX061151
C4-C7	Same as C1	
C8,C9	Capacitor, 100pF	CX0602101
C10	Capacitor, 47pF	CX0600470
C11,C12	Capacitor, 470pF	CX061471
C13	Same as C1	
C14,C15	Same as C2	
C16-C19	Same as C1	
CR1-CR4	Diode, HP2800 (Matched Set)	Matched set of four CR102800
L1-L3	Choke, RF	LX0180832
L4	Choke, RF, .15	LX018081
L5,L6	Choke, RF, .33	LX018083
L7-L9	Same as L1	
Q1-Q4	Transistor, 2N3563	QX053563
R2	Resistor, ¼W, 47	RX111470
R3-R5	Resistor, ¼W, 3.3K	RX011332
R6	Resistor, ¼W, Carbon Comp.,150	RX112151
R7	Resistor, ¼W, 270	RX011271
R8	Resistor, ¼W, 56	RX011560
R9	Same as R6	
R10-R12	Same as R3	
R13	Same as R7	
R14	Same as R8	
R15	Selected	
R16	Same as R8	
T1	Transformer, RF	TX9280815
T2,T3	Transformer, RF	TX928083
T4	Same as T1	

REF. DESIG.	DESCRIPTION	PART NUMBER
A14A4	P C BOARD ASSEMBLY, 270-280 MHZ VCO	808-0203
C1	Capacitor, 150pF	CX061151
C2	Capacitor, 2.2pF	CX06002200
C3-C5	Capacitor, 4.7pF	CX06004700
C6	Capacitor, .01	CX064103
C7,C8	Same as C1	
C9,C10	Same as C6	
C11,C12	Same as C1	
C13	Same as C6	
C15,C16	Same as C6	
CR1	Varicap	CR202101
L1,L2	Choke, RF, 3-3/4T	808-0218-3
L3-L8	Choke, RF, 3-3/4T	LX0180832
Q1-Q3	Transistor, 2N5179	QX055179
R1	Resistor, ¼W, 470	RX011471
R2	Resistor, ¼W, 8.2K	RX011822
R3	Resistor, ¼W, 10K	RX011103
R4	Same as R1	
R7	Same as R2	
R8	Same as R3	
R9	Resistor, ¼W,100	RX011101
R10	Resistor, ¼W, 390	RX011391
R13	Same as R2	
R14	Same as R3	
R15	Same as R9	
R16	Same as R10	

REF. DESIG.	DESCRIPTION	PART NUMBER
A14A5	PC BOARD ASSEMBLY, 280-300 MHZ LOOP AND 20-30 MHZ PHASE DETECTOR	808-0204-1
C1-C5	Capacitor, .01	CX064103
C6	Capacitor, 6.8	CX15685M35
C7-C10	Same as C1	
C11	Same as C6	
C12	Same as C1	
C13	Capacitor, 3300pF	CX061332
C14-C21	Same as C1	
C22,C23	Capacitor, 0.1	CX065104
C24	Same as C6	
C25	Same as C1	
C26	Capacitor, 220pF	CX061221
C27,C28	Same as C1	
C29	Capacitor, 15pF	CX0600150
C30	Capacitor, 10pF	CX0600100
C31	Capacitor, 2.2pF	CX06002200
C32,C33	Capacitor, 22pF	CX0600220
C34	Capacitor, 4.7pF	CX06004700
C35	Same as C32	
C36	Capacitor, 3.3pF	CX06003300
C37	Same as C32	
C38-C53	Same as C1	
C54	Same as C6	
C55	Same as C1	
C56	Same as C6	
C57-C61	Same as C1	
C62	Same as C13	
C63	Same as C1	
C64,C65	Same as C22	
C66,C67	Same as C6	
C68	Same as C26	
C69,C70	Same as C1	
C71	Capacitor, 15pF	CX06001500
C72	Capacitor, 10pF	CX06001000
C73	Same as C31	
C74,C75	Same as C32	
C76	Same as C34	
C77	Same as C32	
C78	Same as C36	
C79	Same as C32	
C80-C93	Same as C1	

REF. DESIG.	DESCRIPTION	PART NUMBER
CR1	Diode, 1N914	CR100914
CR2-CR5	Diode, HP2800 (Matched Set)	Matched set of four CR102800
CR6	Same as CR1	
CR7-CR10	Diode, HP2800 (Matched set)	Matched set of four CR102800
IC1,IC2	Integrated Circuit, CA3046	IC0513046
L1-L4	Choke, 10	LX0180814
L5	Choke, 2.7 mh	LX0180831
L6	Choke, 470	LX0180829
L7	Choke, 4.7	LX0180811
L8	Choke, 3.9	LX0180824
L9	Choke, 6.8	LX0180812
L10-L12	Same as L1	
L13	Same as L5	
L14	Same as L6	
L15	Same as L7	
L16	Same as L8	
L17	Same as L9	
L18-L24	Same as L1	
Q1	Transistor, 2N4275	QX054275
Q2-Q5	Transistor, 2N5172	QX055172
Q6-Q9	Transistor, 2N3563	QX053563
Q10	Same as Q1	
Q11,Q12	Same as Q2	
Q13-Q15	Same as Q6	
R1	Resistor, ¼W, 1K	RX011102
R2	Resistor, ¼W, 3.3K	RX011332
R3	Resistor, ¼W, 2.2K	RX011222
R4	Resistor, ¼W, 1.8K	RX011182
R5	Resistor, ¼W, 100	RX011101
R6	Same as R3	
R7	Same as R1	
R8	Same as R2	
R9	Resistor, ¼W, 150	RX011151
R10	Selected	
R11	Selected	
R12	Same as R1	
R13	Same as R5	
R14	Same as R2	
R15	Same as R5	

REF. DESIG.	DESCRIPTION	PART NUMBER
R16	Same as R2	
R17	Resistor, ¼W, 10K	RX011103
R18	Resistor, ¼W, 4.7K	RX011472
R19	Resistor, ¼W, 220	RX011221
R20	Resistor, ¼W, 6.8K	RX011682
R21	Resistor, ¼W, 22K	RX011223
R22,R23	Resistor, ¼W, 1.5K	RX011152
R24	Same as R18	
R25	Same as R1	
R26	Same as R18	
R27	Same as R17	
R28,R29	Same as R22	
R30	Same as R3	
R31	Resistor, ¼W, 560	RX011561
R32	Same as R5	
R33	Resistor, ¼W, 8.2K	RX011822
R34	Same as R17	
R35	Same as R19	
R36	Resistor, ¼W, 33	RX011330
R37	Same as R1	
R38	Same as R19	
R39	Resistor, ¼W, 22	RX011220
R40	Same as R1	
R41	Same as R33	
R42	Same as R17	
R43	Resistor, ¼W, 56	RX011560
R44	Same as R39	
R45	Same as R1	
R46	Same as R33	
R47	Same as R17	
R48	Same as R33	
R49	Same as R17	
R50	Same as R2	
R51	Same as R1	
R52	Same as R2	
R53	Same as R3	
R54	Same as R4	
R55	Same as R5	
R56	Same as R3	
R57	Same as R1	
R58	Same as R2	
R59	Same as R9	
R60	Selected	
R61	Selected	
R62	Same as R1	
R63	Same as R5	
R64	Same as R2	
R65	Same as R5	

REF. DESIG.	DESCRIPTION	PART NUMBER
R66	Same as R2	
R67	Same as R17	
R68	Same as R18	
R69	Same as R19	
R70	Same as R18	
R71	Same as R17	
R72	Same as R22	
R73	Same as R3	
R74	Same as R22	
R75	Same as R31	
R76	Same as R5	
R77	Same as R33	
R78	Same as R17	
R79	Same as R19	
R80	Same as R36	
R81	Same as R1	
R82	Same as R19	
R83	Same as R39	
R84	Same as R1	
R85	Same as R33	
R86	Same as R17	
R87	Same as R43	
R88	Same as R39	
R89	Same as R1	
R90	Same as R17	
R91	Same as R33	
T1,T2	Transformer, RF	TX928086
T3	Transformer, RF	TX928084
T4,T5	Same as T1	
T6	Same as T3	

REF. DESIG.	DESCRIPTION	PART NUMBER
A15	MODULE ASSEMBLY, VHF LOOP B	808-0193
A15A1	PC BOARD ASSEMBLY, 280-350 MHZ VHF AMPLIFIER	808-0195
C1	Capacitor, 150pF	CX061151
C3	Capacitor, 8.2pF	CX06008200
C4	Same as C1	
C5,C6	Capacitor, .01	CX064103
C7	Same as C1	
C8	Same as C5	
C10	Same as C1	
C11-C13	Same as C5	
C14	Capacitor, 22pF	CX0600220
L1-L6	Choke, Ferrite	LX0180832
Q1,Q2	Transistor, 2N5109	QXO55109
R1	Resistor, ¼W, 1.2K	RX011122
R2	Resistor, ¼W, 1.5K	RX011152
R4	Resistor, ¼W, 12	RX011120
R5	Resistor, ½W, 150	RX012151
R6	Resistor, ¼W, 560	RX011561
R7	Resistor, ¼W, 680	RX011681
R8	Resistor, ¼W, 270	RX011271
R9	Same as R4	
R10	Resistor, ½W, 180	RX012181
R11	Same as R5	

REF. DESIG.	DESCRIPTION	PART NUMBER
A15A2	PC BOARD ASSEMBLY, 280-350 MHZ OSC	808-0196
C1	Capacitor, 150pF	CX061151
C2	Capacitor, 2.2pF	CX06002200
C3-C5	Capacitor, 4.7pF	CX06004700
C6	Capacitor, .01	CX064103
C7,C8	Same as C1	
C9,C10	Same as C6	
C11,C12	Same as C1	
C13	Same as C6	
C15-C18	Same as C6	
CR1	Varicap	CR200000
L1,L2	Choke, RF, 2-3/4T	808-0218-2
L3-L9	Choke, RF, 2-3/4T	LX0170832
Q1-Q3	Transistor, 2N5179	QX055179
R1	Resistor, ¼W, 470	RX011471
R2	Resistor, ¼W, 8.2K	RX011822
R3	Resistor, ¼W, 10K	RX011103
R4	Same as R1	
R7	Same as R2	
R8	Same as R3	
R9	Resistor, ¼W, 100	RX011101
R10	Resistor, ¼W, 390	RX011391
R13	Same as R2	
R14	Same as R3	
R15	Same as R9	
R16	Same as R10	
R17	Same as R1	
R18	Resistor, ¼W, 1.2K	RX011122
R19	Thermistor	RX308082
R20	Resistor, ¼W, 560	RX011561

REF. DESIG.	DESCRIPTION	PART NUMBER
A15A3	PC BOARD ASSEMBLY, 320 MHz LOOP MIXER	808-0197-1
C1	Capacitor, .01	CX064103
C2,C3	Capacitor, 150pF	CX061151
C4-C7	Same as C1	
C8,C9	Capacitor, 100pF	CX0602101
C10	Capacitor, 47pF	CX0600470
C11,C12	Capacitor, 470pF	CX061471
C13	Same as C1	
C14,C15	Same as C2	
C16-C20	Same as C1	
C21	Same as C11	
CR1-CR4	Diode, HP2800 (Matched Set)	Matched set of four CR102800
CR5	Diode, HP2800	CR102800
L1-L3	Choke, RF	LX0180832
L4	Choke, RF, .15	LX018081
L5, L6	Choke, RF, .33	LX018083
L7	Same as L1	
Q1-Q4	Transistor, 2N3563	QX053563
R2	Resistor, ¼W, 56	RX111560
R3-R5	Resistor, ¼W, 3.3K	RX011332
R6	Resistor, Carbon Comp, 150	RX112151
R7	Resistor, ¼W, 270	RX011271
R8	Not Used	
R9	Same as R6	
R10-R12	Same as R3	
R13	Same as R7	
R14	Same as R2	
R15	Selected	
R16	Same as R14	
T1	Transformer	TX9280815
T2, T3	Transformer	TX928083
T4	Same as T1	

REF. DESIG.	DESCRIPTION	PART NUMBER
A15A4	PC BOARD ASSEMBLY, 320 MHZ VCO	808-0198-1
C1	Capacitor, 150 pF	CX061151
C2	Capacitor, 2.2pF	CX06002200
C3-C5	Capacitor, 4.7pF	CX06004700
C6	Capacitor, .01	CX064103
C7,C8	Same as C1	
C9,C10	Same as C6	
C11,C12	Same as C1	
C13	Same as C6	
C15-C17	Same as C6	
CR1	Varicap	CR202107
L1	Choke, RF,1-3/4T	808-0218-1
L2	Choke, RF, 3/4 T	808-0218-4
L3-L9	Choke, RF	LX0180832
Q1-Q3	Transistor	2N5179
R1	Resistor, ¼W, 470	RX011471
R2	Resistor, ¼W, 8.2K	RX011822
R3	Resistor, ¼W, 10K	RX011103
R4	Same as R1	
R7	Same as R2	
R8	Same as R3	
R9	Resistor, ¼W, 100	RX011101
R10	Resistor, ¼W, 390	RX011391
R13	Same as R2	
R14	Same as R3	
R15	Same as R9	
R16	Same as R10	
R17	Resistor, ¼W, 2.7K	RX011272
R18	Resistor, ¼W, 4.7K	RX011472

REF. DESIG.	DESCRIPTION	PART NUMBER
A15A5	PC BOARD ASSEMBLY, 320 MHZ LOOPS	808-0199
C1-C9	Capacitor, .01	CX064103
C10	Capacitor, 6.8	CX15685M35
C11-C17	Same as C1	
C18	Same as C10	
C19	Same as C1	
C20	Same as C10	
C21-C23	Same as C1	
C24	Not used	
C25	Same as C1	
C26	Capacitor, 220pF	CX061221
C27-C34	Same as C1	
C35	Same as C10	
C36	Same as C1	
C37	Same as C10	
C38-C41	Same as C1	
C42	Capacitor, 22pF	CX0600220
C43-C48	Same as C1	
C49	Capacitor, .001	CX061102
C50	Same as C1	
C51	Same as C42	
C52	Capacitor, 3.3 pF	CX06003300
C53	Same as C42	
C54	Capacitor, 4.7pF	CX06004700
C55	Capacitor, 15pF	CX0600150
C56	Same as C42	
C57	Capacitor, 10pF	CX06001000
C58	Same as C55	
C59	Same as C10	
C60-C62	Same as C1	
C63	Same as C10	
C64-C66	Same as C1	
C67	Same as C10	
C68	Capacitor, .0033	CX061332
C69	Capacitor 47pF	CX062470
C70-C74	Same as C1	
C75	Same as C10	
C76,C77	Capacitor, .22	CX065104
C78	Same as C10	
C79	Same as C26	
C80-C81	Same as C1	
CR1	Diode, 1N277	CR050277
CR2-CR5	Diode, HP2800 (matched set)	Matched set of four CR102800

REF. DESIG.	DESCRIPTION	PART NUMBER
CR6,CR7	Diode, 1N914	CR100914
CR8	Diode, 1N914	CR100914
IC1	Integrated Circuit, MC870P	IC0510870
IC2	Not Used	
IC3	Integrated Circuit, MC1010P	IC0511010
IC4	Integrated Circuit, CA3046	IC053046
L1-L10	Choke, 10	LX0180814
L11	Choke, Ferrite	LX0180832
L12	Choke, 47	LX0180818
L13	Same as L1	
L14	Choke, 2.7 mh	LX0180831
L15	Choke 680	LX0180830
L16	Choke, 27	LX0180826
L17,L18	Choke, 18	LX0180825
L19,L20	Same as L1	
L21	Same as L11	
Q1-Q9	Transistor, 2N5172	QX055172
Q10-Q12	Transistor, 2N3563	QX053563
Q13	Transistor, 2N4275	QX054275
Q14	Transistor, 2N4258	QX054258
Q15	Same as Q1	
Q16-Q18	Transistor, 2N5138	QX055138
Q19	Same as Q13	
Q20,Q21	Same as Q1	
Q22,Q23	Transistor	QX958083
R1	Resistor, ¼W, 10K	RX011103
R2, R3	Resistor, ¼W, 4.7K	RX011472
R4, R5	Potentiometer, Carbon, 1K	RX200102
R6, R7	Resistor, ¼W, 2.5K	RX200252
R8	Resistor, ¼W, 5K	RX200502
R9	Resistor, ¼W, 10K	RX200103
R10	Resistor, ¼W, 50K	RX200503
R11	Same as R6	
R12	Resistor, ¼W, 100	RX011101
R13	Resistor, ¼W, 560	RX011561
R14	Resistor, ¼W, 1.2K	RX011122
R15	Resistor, ¼W, 2.2K	RX011222
R16	Resistor, ¼W, 3.3K	RX011332
R17	Resistor, ¼W, 5.6K	RX011562
R18	Same as R1	
R19	Resistor, ¼W, 6.8K	RX011682
R20-R26	Same as R1	
R27	Same as R2	
R28	Not Used	
R29	Resistor, ¼W, 270	RX011271

REF. DESIG.	DESCRIPTION	PART NUMBER
R30	Not Used	
R31	Same as R1	
R32	Resistor, ¼W, 3.9K	RX011392
R33	Resistor, ¼W, 8.2K	RX011822
R34	Resistor, ¼W, 15K	RX011153
R35	Same as R15	
R36	Same as R1	
R37,R38	Same as R15	
R39	Same as R34	
R40	Resistor, ¼W, 470	RX011471
R41	Resistor, ¼W, 56	RX011560
R42	Same as R33	
R43	Same as R1	
R44	Same as R12	
R45	Resistor, ¼W, 22	RX011220
R46	Resistor, ¼W, 1K	RX011102
R47	Same as R33	
R48	Same as R1	
R49	Resistor, ¼W, 47	RX011470
R50	Same as R45	
R51	Same as R46	
R52	Same as R2	
R53	Same as R33	
R54	Same as R1	
R55	Resistor, ¼W, 33	RX011330
R56	Same as R15	
R57	Same as R40	
R58	Selected	
R59	Resistor, ¼W, 22K	RX011223
R60	Same as R46	
R61	Same as R1	
R62	Same as R16	
R63	Same as R46	
R64,R65	Same as R29	
R66	Same as R14	
R67	Same as R46	
R68	Same as R16	
R69	Same as R12	
R70	Same as R15	
R71	Resistor, ¼W, 1.8K	RX011182
R72	Same as R15	
R73	Same as R46	
R74	Same as R16	
R75	Resistor, ¼W, 150	RX011151
R76	Same as R12	
R77	Same as R34	
R78	Selected	
R79	Same as R16	
R80,R81	Same as R46	

REF. DESIG.	DESCRIPTION	PART NUMBER
R82	Same as R2	
R83	Same as R40	
R84	Same as R12	
R85	Same as R16	
R86	Same as R1	
R87	Same as R46	
R88	Same as R2	
R89	Same as R1	
R90,R91	Resistor, ¼W, 1.5K	RX011152
R92	Same as R15	
R93	Same as R1	
R94	Same as R1	
R95	Resistor, ¼W, 39K	RX011393
R96	Same as R14	
R97	Selected	
R98	Resistor, ¼W, 82	RX011820
T1,T2	Transformer, RF	TX928084
T3	Transformer, RF	TX928085

REF. DESIG.	DESCRIPTION	PART NUMBER
A16	PC BOARD ASSEMBLY, DISCRIMINATOR	808-0149
C1	Capacitor, 22pF	CX0600220
C2,C3	Capacitor, 6.8, 35V	CX15685M35
C4,C5	Capacitor, .001	CX061102
C6	Capacitor, 220pF	CX061221
C7,C8	Capacitor, 470pF	CX061471
C9	Same as C1	
C10, C11	Same as C2	
C12-C17	Same as C4	
C18	Not used	
C19	Same as C2	
C20	Capacitor, .01	CX064103
C21	Same as C2	
C22	Same as C20	
C23	Same as C2	
C24	Same as C20	
C25,C26	Same as C6	
C27	Capacitor, 3.3pF	CX06003300
C28	Same as C6	
C29	Same as C20	
C30	Capacitor, 50, 15V	CX0150015
C31-C34	Capacitor, 1, 35V	CX15105M35
C35	Same as C20	
C36-C38	Same as C2	
CR1-CR6	Diode, 1N914	CR100914
CR7	Diode, 1N2070	CR918051
DL1	Delay Line	XX0308081
IC1	Integrated Circuit, MC1010	IC0511010
IC2	Integrated Circuit, MC1004	IC0511004
IC3, IC4	Same as IC1	
IC5	Integrated Circuit, SN72709N	IC0510709
IC6-IC11	Integrated Circuit,SN7493	
IC12	Integrated Circuit, SN72709N	IC0510709
K1	Relay	KX208082
L1	Choke, 680	LX0180830
L2-L5	Choke, 33	LX0180817
Q1	Transistor, 2N5138	QX055138
Q2	Transistor, 2N5133	QX055133
Q3, Q4	Transistor, 2N4275	QX054275
Q5-Q7	Same as Q1	

REF. DESIG.	DESCRIPTION	PART NUMBER
Q8	Same as Q2	
Q9,Q10	Transistor, 2N5172	QX055172
Q11,Q12	Same as Q1	
Q13-Q16	Same as Q9	
Q17	Same as Q3	
Q18,Q19	Same as Q9	
Q20-Q22	Same as Q3	
Q23,Q24	Same as Q1	
R1	Resistor, ¼W, 1.5K	RX011152
R2	Resistor, ¼W, 10	RX011100
R3, R4	Resistor, ¼W,220	RX011221
R5	Resistor, ¼W, 2.2K	RX011222
R6	Potentiometer, Carbon, 2.5K	RX200252
R7	Resistor, ¼W, 6.8K	RX011682
R8	Resistor, ¼W, 330	RX011331
R9	Resistor, ¼W, 680	RX011681
R10, R11	Resistor, ¼W, 390	RX011391
R12	Same as R3	
R13,R14	Same as R1	
R15	Resistor, ¼W, 4.7K	RX011472
R16	Resistor, ¼W, 3.9K	RX011392
R17	Resistor, ¼W, 1K	RX011102
R18	Resistor, ¼W, 18K	RX011183
R19	Same as R5	
R20	Resistor, ¼W, 10K	RX011103
R21	Same as R7	
R22	Resistor, ¼W, 5.6K	RX011562
R23	Resistor, ¼W, 3.3K	RX011332
R24	Same as R18	
R25	Resistor, ¼W, 47	RX011470
R26	Same as R20	
R27	Same as R1	
R28	Same as R17	
R29,R30	Resistor, ¼W, 470	RX011471
R31	Same as R22	
R32	Same as R17	
R33-R35	Same as R23	
R36	Same as R15	
R37	Resistor, ¼W, 2.7K	RX011272
R38-R41	Same as R23	
R42,R43	Same as R20	
R44	Same as R37	
R45,R46	Same as R1	
R47	Same as R15	
R48	Same as R20	
R49	Resistor, ¼W, 1.2K	RX011122

REF. DESIG.	DESCRIPTION	PART NUMBER
R50,R51	Same as R20	
R52	Same as R22	
R53	Same as R20	
R54	Resistor, ¼W, 56K	RX011563
R55	Resistor, ¼W, 22K	RX011223
R56	Same as R20	
R57	Same as R16	
R58	Same as R15	
R59	Same as R29	
R60	Same as R15	
R61	Same as R29	
R62	Resistor, ¼W, 6.81K, 1%	RX1026811
R63	Same as R1	
R64	Resistor, ½W, 1780,1%	RX1021781
R65	Resistor, ½W, 220	RX012221
R66	Same as R64	
R67	Same as R1	
R68	Same as R15	
R69	Same as R17	
R70	Same as R20	
R71	Same as R23	
R72	Same as R17	
R73	Same as R5	
R74	Same as R1	
R75,R76	Same as R17	
R77	Same as R7	
R78	Same as R17	
R79-R82	Same as R1	
R83	Same as R18	
R84	Resistor, ¼W, 3.01K, 1%	RX1023011
R85	Same as R15	
R86	Same as R1	
R87	Resistor, ¼W, 8.2K	RX011822
R88	Potentiometer, Carbon, 5K	RX200502
R89	Same as R1	
R90	Same as R37	
R91	Potentiometer, Carbon, 10K	RX200103
R92	Selected	

REF. DESIG.	DESCRIPTION	PART NUMBER
A17	PC BOARD ASSEMBLY, MIXER/DIVIDER	808-0205
C1	Capacitor, 6.8, 35V	CX15685M35
C2,C3	Capacitor, .01, 25V	CX064103
C4	Capacitor, 3.3pF	CX06003300
C5	Capacitor, 15pF	CX0600150
C6	Same as C2	
C7	Same as C1	
C8	Capacitor, 10pF	CX0600100
C9	Same as C2	
C10	Capacitor, 33pF	CX0600330
C11	Same as C1	
C12,C13	Same as C2	
C14	Same as C1	
C15	Same as C2	
C16	Same as C1	
C17,C18	Same as C2	
C19	Same as C1	
C20-C27	Same as C2	
C28-C30	Same as C8	
C31-C37	Same as C2	
CR1	Diode, 1N914	CR100914
IC1	Integrated Circuit, MC1023	IC0511023
IC2	Integrated Circuit, MC1027	808-0343-2
IC3	Integrated Circuit, MC1007	IC0511007
IC4-IC7	Integrated Circuit, MC1013	IC0511013
L1,L2	Choke, 33	LX0180817
L3	Choke, 2.7	LX0180827
L4	Choke, 3.3	LX0180810
L5	Choke, 3-3/4 Turns	808-0218-3
L6	Choke, .68	LX018085
L7	Choke, 10	LX0180814
L8	Same as L1	
L9-L13	Same as L7	
L14-L16	Choke, 33	LX0180817
Q1-Q6	Transistor, 2N3563	QX053563
R1,R2	Resistor, ¼W, 33	RX011330
R3	Resistor, ¼W, 1.2K	RX011122
R4	Resistor, ¼W, 820	RX011821
R5	Not Used	
R6	Resistor, ¼W, 270	RX011271
R7	Resistor, ¼W, 680	RX011681

REF. DESIG.	DESCRIPTION	PART NUMBER
R8	Resistor, ¼W, 22K	RX011223
R9	Resistor, ¼W, 47	RX011470
R10	Resistor, ¼W, 100	RX011101
R11	Same as R6	
R12	Resistor, ¼W, 1.8K	RX011182
R13	Resistor, ¼W, 120	RX011121
R14	Resistor, ¼W, 150	RX011151
R15	Same as R3	
R16	Same as R6	
R17	Same as R3	
R18	Same as R7	
R19	Same as R14	
R20,R21	Resistor, ¼W, 2.7K	RX011277
R22	Resistor, ¼W, 4.7K	RX011472
R23,R24	Same as R20	
R25	Same as R22	
R26	Resistor, ¼W, 1.5K	RX011152
R27	Resistor, ¼W, 10	RX011100
R28	Same as R22	
R29	Resistor, ¼W, 100	RX011100
R30	Same as R3	
R31	Same as R7	
T1,T2	Transformer	TX9380815

REF. DESIG.	DESCRIPTION	PART NUMBER
A18	PC BOARD ASSEMBLY, AM OUTPUT LOOPS	808-0238
C1	Capacitor, 220pF	CX061221
C2,C3	Capacitor, .01	CX064103
C4	Capacitor, .47	CX15474M35
C5,C6	Capacitor, 6.8	CX15685M35
C7	Same as C2	
C8	Capacitor, 470pF	CX061471
C9	Capacitor, 22pF	CX0600220
C10	Not Used	
C11,C12	Same as C5	
C13	Same as C2	
C14	Same as C8	
C15,C16	Same as C9	
C17,C18	Same as C5	
C19	Same as C2	
C20-C22	Same as C5	
C23	Same as C2	
C24	Capacitor, 150pF	CX061151
C25,C26	Same as C2	
C27	Same as C24	
C28	Capacitor, 820pF	CX061821
C29	Capacitor, 680pF	CX061681
C30,C31	Same as C2	
C32	Same as C29	
C33	Same as C9	
C34	Capacitor, 330pF	CX061331
C35	Not Used	
C39,C40	Capacitor, 15pF	CX0600150
C41	Capacitor, 250, 15V	CX01251015
C42	Same as C39	
C43	Capacitor, 6.8pF	CX06006800
C44,C45	Capacitor, 68pF	CX0602680
C46	Capacitor, 33pF	CX0600330
C47,C48	Capacitor, Feedthru	CX161102
C49	Capacitor, 470pF	CX061471
CR1,CR1	Diode, 1N277	CR050277
CR3-CR5	Diode, 1N914	CR100914
CR6	Diode, HP2800	CR102800
CR7	Diode, 1N756A	CR150756
CR8	Same as CR1	
CR9	Diode, 1N751	CR150751
CR11-CR14	Diode, HP2800 (Matched Set)	Matched set of four CR102800
IC1	Integrated Circuit, SN72709N	IC0510709
IC2	Integrated Circuit, SN72709N	808-034303

REF. DESIG.	DESCRIPTION	PART NUMBER
L1,L2	Choke, 1	LX018187
L3-L5	Choke	LX0180832
L7	Same as L3	
L8	Choke, 7-3/4 Turns	808-0284
L9	Not Used	
L10,L11	Same as L3	
L12	Inductor	808-0285
L13	Choke, 3-3/4 Turns	808-0286
L14,L15	Choke, .15	LX018081
Q1	Transistor, 2N5138	QX055138
Q2	Transistor, 2N5133	QX055133
Q3	Transistor, 2N5172	WZ055172
Q4	Transistor, 2N3568	QX053568
Q5-Q7	Transistor, 2N3563	QX053563
Q8	Transistor, TA7153	QX057153
R1	Resistor, ¼W, 100	RX011101
R2	Resistor, ¼W, 10K	RX011103
R3	Resistor, ¼W, 2.2K	RX011222
R4,R5	Same as R2	
R6	Potentiometer, 10K	RX200103
R7	Same as R1	
R8	Resistor, ¼W, 1.5K	RX011152
R9	Resistor, ¼W, 1K	RX011102
R10	Same as R2	
R11,R12	Resistor, ¼W, 68K	RX011683
R13	Resistor, ¼W, 47K	RX011473
R14	Resistor, ¼W, 4.7K	RX011472
R15	Resistor, ¼W, 22K	RX011223
R16	Potentiometer, 10K	RX201103
R17	Same as R13	
R18	Resistor, ¼W, 6.8K	RX011682
R19	Resistor, ¼W, 150K	RX011154
R20	Same as R16	
R21	Resistor, ¼W, 22K	RX011223
R22	Same as R8	
R23	Resistor, ¼W, 470	RX011471
R24	Same as R13	
R25	Resistor, ¼W, 150	RX011151
R26	Resistor, ¼W, 560	RX011561
R27	Same as R1	
R28	Resistor, ¼W, 5.6K	RX011562
R29	Resistor, ¼W, 47	RX011470
R30	Resistor, ¼W, 8.2K	RX011822
R31	Same as R1	
R32	Same as R2	
R33	Resistor, ¼W, 330	RX011331
R34,R35	Same as R29	

REF. DESIG.	DESCRIPTION	PART NUMBER
R36	Same as R14	
R37	Resistor, ¼W, 220K	RX011224
R38	Same as R19	
R39	Same as R26	
R40	Same as R1	
R41	Same as R30	
R42	Same as R1	
R43	Resistor, ¼W, 150	RX011471
T1	Transformer	TX928083
T2,T3	Transformer	TX928082
T4	Same as T1	
T5	Transformer	TX9280815

REF. DESIG.	DESCRIPTION	PART NUMBER
A19	PC BOARD ASSEMBLY, OUTPUT AMPL	808-0178
C1	Capacitor, 6.8	CX15685M35
C2	Capacitor, .1	CX063104
C3-C5	Same as C1	
C6	Capacitor, .01	CX064103
C7	Capacitor, 4.7pF	CX06004700
C8	Same as C6	
C9	Capacitor, 680pF	CX061681
C10	Capacitor, 68pF	CX0600680
C11	Same as C1	
C12	Capacitor, .22	CX066224
C13,C14	Same as C1	
C15	Capacitor, 10pF	CX0600100
C16	Capacitor 220pF	CX061221
C17	Capacitor, 6.8pF	CX06006800
C18	Same as C9	
C19	Capacitor, 33pF	CX0600330
C20,C21	Same as C6	
C22	Same as C1	
C23	Same as C6	
C24	Same as C2	
C25	Same as C6	
C26	Capacitor, 22pF	CX0600220
C27	Same as C2	
C29	Same as C1	
C30	Same as C6	
C31	Same as C10	
C32	Same as C16	
C33	Selected	
CR1-CR8	Diode, HP2800	CR102800
CR9	Diode 1N914	CR100914
CR10,CR11	Diode, 1N277	CR050277
CR12,CR13	Same as CR1	
CR14	Same as CR9	
CR15	Same as CR1	
CR16,CR17	Same as CR9	
K1	Relay, Reed	KX208081
L1,L2	Choke, Ferrite	LX0180833
L3	RF Choke	LX908081
L4	Inductor, 1.0	LX018087
L5	Choke,Ferrite	EX140002
L6	Coil RF Assy	LX908082
L7-L9	Choke, Toroidal	TX9280813
L10,L11	Same as L1	
L12,L13	Bead, Ferrite	EX140003
L15,L16	Same as L12	
Q1	Transistor, 2N3563	QX053563

REF. DESIG.	DESCRIPTION	PART NUMBER
Q2	Transistor, 2N5109	QX055109
Q3	Transistor	QX958051
Q4	Transistor	QX958082
Q5-Q8	Same as Q1	
Q9,Q10	Same as Q4	
Q11,Q12	Transistor, Silicon, NPN	QX055172
Q13	Transistor, 2N4258	QX054258
Q14	Transistor, 2N4275	QX054275
Q15,Q16	Same as Q11	
R1	Resistor, ½W, 270	RX012271
R2	Resistor, ½W, 68	RX012680
R3	Resistor, ¼W, 3.3k	RX011332
R4,R5	Resistor, ¼W, 1.0K	RX011102
R6	Resistor, ½W, 1.2K	RX012122
R7,R8	Resistor, ¼W, 560	RX011561
R9, R10	Resistor, ½W, 470	RX012471
R11	Resistor, ¼W, 4.7K	RX011472
R12	Resistor, ¼W, 10	RX011100
R13	Resistor, ¼W, 27	RX011270
R14	Same as R7	
R15	Resistor, ½W, 220	RX012221
R16,R17	Resistor, ¼W, 47	RX011470
R18	Resistor, ¼W, 270	RX011271
R19	Resistor, ¼W, 82	RX011820
R20	Same as R16	
R21	Resistor, ¼W, 100	RX011101
R22	Resistor, ¼W, 33	RX011330
R23	Same as R12	
R24,R25	Same as R16	
R26	Same as R22	
R27	Resistor, ¼W, 39	RX011390
R28,R29	Same as R12	
R30	Same as R21	
R31	Same as R12	
R32	Resistor, ¼W, 390	RX011391
R33	Same as R21	
R34,R35	Resistor, ¼W, 470	RX011471
R37	Resistor, ¼W, 680	RX011681
R38	Resistor, Variable 100	RX200101
R39	Resistor, ¼W, 180	RX011181
R40	Resistor, ¼W, 56	RX011560
R41	Resistor, ¼W, 12K	RX011123
R42	Resistor, ¼W, 5.6K	RX011562
R43	Same as R41	
R44	Resistor, ¼W, 10K	RX011103
R45,R46	Resistor, ½W, 100, 1%	RX1021000

REF. DESIG.	DESCRIPTION	PART NUMBER
R47	Resistor, ¼W,22	RX011220
R48	Same as R34	
R49	Same as R37	
R50	Resistor, ¼W,1.2K	RX011122
R51	Resistor, ¼W, 220	RX011221
R52	Same as R7	
R53	Resistor,¼W,2.2K	RX011222
R54	Resistor, ½W,56	RX012560
R55	Same as R 16	
R56	Same as R43	
T1, T2	Transformer, RF	TX9280814

REF. DESIG.	DESCRIPTION	PART NUMBER
A20	PC BOARD ASSEMBLY, STANDARD DIVIDER	808-0128
C1-C3	Capacitor, 50, 15V	CX0150015
CR1	Diode, 1N914	CR100914
IC1-IC6	Integrated Circuit, MC890P	IC0510890
IC7	Integrated Circuit, MC889P	IC0510890
L1-L3	Choke, 10	LX0180814
R1	Resistor, ¼W, 820	RX011821

R F COMMUNICATIONS, INC.
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A SUBSIDIARY OF HARRIS-INTERTYPE CORPORATION

Product Newsletter

PRD ELECTRONICS, INC.
1200 PROSPECT AVE.
WESTBURY, N.Y. 11590
(516) 334-7810

NUMBER 10 MARCH 1974

NOW BETTER THAN EVER, THE NEW PRD 7808 AND PRD 7828

As part of an ongoing program at PRD to improve our products, we have just completed an update program to considerably improve the reliability and maintainability, and also to simplify the operation of both our 7808 Signal Generator and our 7828 Synthesizer.

Reliability will be improved by using fewer components, more reliable power transistors, and coaxial reed relays. In general, the amount of power dissipated internally is greatly reduced, allowing the units to operate at much cooler temperatures than before.

On the following pages you will find a brief description of the changes being incorporated.

PRD ELECTRONICS, INC. HARRIS
A SUBSIDIARY OF HARRIS-INTERTYPE CORP.

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